Imperial Bureau of Plant Genetics

(For Crops other than Herbage)

Plant Breeding Abstracts

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Note.—Initialled abstracts are written by the following:

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* General studies, see also individual crops.

Plant Breeding Abstracts.

Vol. VII, No. 2.

Part 1. Empire Section

STATISTICS 519

370. ALLAN, F. E. 519.24
Some principles of statistics and their application to agricultural experiments. II.
J. Aust. Inst. Agric. Sci. 1936 : **2** : 67–75.
ALLAN, F. E.
Some principles of statistics and their application to agricultural experiments. III.
J. Aust. Inst. Agric. Sci. 1936 : **2** : 109–16.
In part II an account is given of the normal distribution, "Student's" t test and Fisher's analysis of variance. Part III deals with the fitting of regression lines and calculation of regression and correlation coefficients, with tests of their significance. The use of the analysis of covariance to increase the precision of an experiment is illustrated by an example.

371. GUHA ROY, K. K. and MAHALANOBIS, P. C. 519.24
Statistical methods and their application to agronomy. A bibliography.
Misc. Bull. Imp. Coun. Agric. Res. Delhi 1936 : No. 9 : Pp. 120.
A classified list of books and articles on statistics in relation to agriculture and biology.

372. SMITH, H. F. 519.24
The problem of comparing the results of two experiments with unequal errors.
J. Coun. Sci. Industr. Res. Aust. 1936 : **9** : 211–12.
Combination of two experiments in a single analysis of variance with a pooled estimate of error is not permissible when the experimental errors are not approximately equal. The author suggests how a comparison of treatment and error variance can be made in such a case, and shews that while the correct test, the method of approach to which has been indicated by Fisher, would require elaborate tables, a sufficiently good approximation may be had by means of Fisher's z-test. J. W.

373. SORNAY, A. DE 519.24
On a further use of the working mean in statistical analysis.
Rev. Agric. Maurice 1936 : No. 86 : Pp. 8.
When calculations have been made of the standard deviations from two separate groups of data, generally by the use of working means and corresponding corrections, it is often required to find the standard deviation for the two groups taken together, about their common mean. Formulae are given for carrying out this calculation from the figures for the separate groups. This can be applied to the two standard deviations in the case of two varieties, while a further formula is used for the sums of products of deviations in order to calculate the correlation coefficient for the combined data. J. W.

374. SINGH PUREWAL, S. and KRISHNA RAO, P. 519.241.6:575.11
Tables of standard errors of Mendelian ratios.
Misc. Bull. Imp. Coun. Agric. Res. 1936 : No. 11 : Pp. 37.
The tables give the standard error, expressed in numbers of individuals, for the Mendelian ratios 1 : 1, 3 : 1, 9 : 7, 15 : 1, 13 : 3, 27 : 37 and 63 : 1, calculated from the formula $\sqrt{p.q.n}$, where $p : q$ = the ratio concerned, $p + q$ being unity, and n = the number of individuals.

The standard errors for the 1 : 1 ratio, expressed in percentages are also given, calculated from the formula $\sqrt{\frac{p.q}{n}}$ The values of n in the tables range from 5 to 1,000, and standard errors for any value up to 100,000 can be obtained by moving the decimal point and applying linear interpolation.

GENETICS 575

375. GATES, R. R. 575:581.9:576.12

Genetical and taxonomic investigations in the genus *Oenothera.*

Philos. Trans. 1936 : **226** : Ser. B : 239–355.

An account of a survey of the genus in Eastern Canada and neighbouring territories combining genetic and taxonomic methods. There are described 17 new species and 15 new varieties, all producing a ring of 14 chromosomes at meiosis. Several mutations are also described. The importance of the results with respect to evolution in this genus is indicated.

376. 575:633(54)
58.007

Dr. F. J. F. Shaw.

Nature, Lond. 1936 : **138** : 317–18.

An obituary notice in which his work on breeding is briefly described, in particular that concerned with the development of a pigeon pea resistant to *Fusarium vasinfectum.*

377. 575:633(68)
575:633.2(68)

The plant industry and its problems.

Fmg S. Afr. 1936 : **11** : 372–74, 380.

An account of the work of the Division of Plant Industry, Pretoria. *Inter alia* a study is being made of indigenous plants from the economic standpoint, of tobacco varieties, the improvement of varieties of hops, field crops, pasture and hay grasses, indigenous sorghums, maize, Kaffir corn and legumes. At the Prinshof Grass Breeding Station efforts are being made to breed strains of grasses producing abundant viable seed and promising results have been obtained.

378. SUMMERBY, R. 575:633(71.4)

Improved varieties of farm crops from Macdonald College.

Fm Bull. Macdonald Coll. Quebec 1936 : No. 6 : Pp. 23.

After a brief account of the methods of breeding by selection or hybridization, descriptions are given of the varieties bred or introduced and distributed by the College. They are as follows :—

Oats.—Banner 44 M.C., a selection from Banner ; Alaska, obtained from Ontario Agricultural College ; and Cartier, from the cross between Early Triumph No. 108 and Alaska ;

Barley.—Pontiac, a selection from Mandscheuri ; Oxford, from a cross between Guy Mayle and Mensury 3207 ; and Byng, from a cross between a Michigan Experiment Station line No. 31604, and a strain of common six-rowed, one of the lines from this cross being then further crossed with Mensury 3207 ;

Wheat.—Kharkov 22 M.C., a selection from the old variety Kharkov is the only variety released ;

Rye.—A strain of winter rye, named Fall Rye 514 M.C., produced by selection ;

Maize.—Two selected varieties, Quebec 28 M.C. from Quebec yellow, and North Western Dent M.C. from a commercial source, and two varietal hybrids, Iroquois (Quebec 28 M.C. x Stowells Evergreen) and Algonquin (Quebec 28 M.C. x Wisconsin No. 9) ;

Soya beans.—Quebec 92, a grain variety and Quebec 537, a forage variety both selected from Early Yellow ;

Mangolds.—Yellow Intermediate M.C., produced by mass selection ;

Swedes.—Bangholm 8112 M.C., a selection, and Laurentian, a selection from Bangholm 8112.

A variety of clover, Dollard, is also mentioned.

Breeding work is still progressing and many promising lines are being tested.

379. 575:633(94)
WATT, R. D. 63:061.6(94)
Landmarks and problems of agricultural science in Australia.
J. Aust. Inst. Agric. Sci. 1936 : **2** : 49–53.
Reference is made to the work of the different bodies and institutions concerned with agriculture in Australia, and special mention is made of the introduction and breeding of new varieties, in particular the work of Farrer.

380. MILES, L. G. 575:633:575.12
Back-crossing and its use in plant breeding.
J. Aust. Inst. Agric. Sci. 1935 : **1** : 163–65.
It is shewn theoretically that back-crossing a hybrid for six generations to a homozygous parent without selection should result in sufficient homozygosity for practical purposes. Hence to transfer a single dominant factor from one variety to another the procedure recommended is to cross the two and back-cross to the latter variety for five or six generations, selecting for the character in each generation. This will yield a progeny identical with the second variety, but heterozygous for the character being transferred. The desired homozygous form will then be obtained on selfing. When the character to be transferred is recessive the programme must be lengthened by periodic selfings to bring to light the recessive character. Even after three generations of back-crossing one-eighth of the progeny should carry the recessive factor in the heterozygous condition.

381. SETHI, R. L., SETHI, B. L. and MEHTA, T. R. 575:633:575.12
Methods of improvement in crops: improvement by hybridization.
Agric. Live-Stk India 1936 : **6** : 494–503.
In this account of the exploitation of hybridization in breeding improved varieties of crop plants, examples are given of advances made by this method, and a description is given of the procedure and the difficulties which may be encountered.

382. TOIT, F. M. DU 575:633–1.524
Possibilities of the introduction of new crops.
Fmg S. Afr. 1936 : **11** : 327–28.
Reference is made to the value of introductions of new material for breeding, such as has been practised by the U.S.S.R. and the U.S.A., and it is suggested that equal benefits are likely to accrue from such a policy in South Africa.

383. FISHER, R. A. 575.1
Has Mendel's work been rediscovered?
Ann. Sci. Lond. 1936 : **1** : 115–37.
A careful examination of Mendel's classical paper on plant hybridization, with observations on the reaction of Mendel's contemporaries to his work and also its use by Bateson in connexion with the latter's opposition to the theory of Natural Selection, which theory is shewn to be in fact not incompatible with Mendel's views.
The paper itself is shewn to be most probably a literal account of Mendel's experiments. It is also shewn by the χ^2 method that there is a tendency throughout for the experimental results to fit too well; moreover in the testing of gametic ratios the experimental results gave better agreement with ratios which do not take into account the fact that a proportion of heterozygous plants would give nothing but dominants (owing to the small progenies grown) than they did with the ratios which ought to occur if allowance were made for this. The general conclusions are reached that Mendel had deduced the factorial theory of inheritance beforehand and planned his experiments with it in mind, and also that the numerical ratios obtained he regarded, at any rate after his very first experiments with seed characters, as a demonstration for others rather than for his own enlightenment, for he ignored many opportunities of verifying them.
The general tendency of other workers reading Mendel's paper seems to have been to find what they expected to find, and to ignore what they did not expect to find. The author concludes that only a succession of publications and the continuous iteration of all new opinions seem sufficient to bring about the general recognition of a new discovery.

384. 575.1
PHIPPS, I. F. 575:633
Recent developments in genetics and plant breeding.
J. Aust. Inst. Agric. Sci. 1936 : **2** : 107–09.
A summary of an address on the results of modern research in these two fields.

385. STRÖER, W. F. H. 575.17
The gene, its function and its meaning in genetics.
Quart. Rev. Biol. 1936 : **11** : 57–69.
A discussion of many of the modern viewpoints on the nature and action of the gene, in which the view is represented that the genes are not to be regarded as units composing the organism but as portions of the organism which direct but do not necessarily control its course of development.

386. 575.41:575.1
Genetics and ecology in relation to selection.
Nature, Lond. 1936 : **138** : 748–49.
A report of a discussion on selection by the Zoology section of the British Association, 1936. The importance both of the environment and of the rest of the gene complex for the value of a mutation was stressed. Mimicry and sexual selection were also discussed.

EVOLUTION 576.12

387. HUXLEY, J. S. 576.12:575.41
Natural selection and evolutionary progress.
Nature, Lond. 1936 : **138** : 571–73, 603–05.
After discussing the nature of natural selection under conditions of Mendelian inheritance the author emphasizes the multiplicity of the processes which may be concerned in the origin of species. He then goes on to shew that natural selection must be invoked to explain adaptation, and also demonstrates its importance in connexion with long-range evolutionary trends. The effect of genes affecting the rate of certain processes is shewn to be capable of important repercussions.
In conclusion, the nature of evolutionary progress is discussed, with special reference to man.

CYTOLOGY 576.3

388. THOMAS, P. T. 576.312.34:575.11
Genotypic control of chromosome size.
Nature, Lond. 1936 : **138** : p. 402.
A male-sterile plant of *Lolium perenne*, with chromosomes about a quarter of the size of the normal, was crossed with a normal plant and gave eight male-sterile seedlings, two of which were examined. One had chromosomes about the normal size for the species, while the other had chromosomes more than twice this size. The difference is considered to be due to segregation of the factors genetically controlling chromosome size.

AGRICULTURE 63

389. 63:061.3(54)
631.421:519.24
631.524:061.6(54)
Proceedings of the first meeting of the Crops and Soils Wing of the Board of Agriculture and Animal Husbandry in India, held at Delhi from the 25th February to the 2nd March, 1935.
Delhi, 1936 : Pp. 377.
Among the topics discussed, those of interest to plant breeders related to the planning, technique and interpretation of field experiments and to the establishment of a bureau of plant introduction.

The committee reporting on the former topic emphasized the desirability of all field experiment work being conducted in conformity with the technique developed by Fisher. In certain types of experiments, such as variety tests, standardization might be desirable, more particularly in the presentation of the results, while in other tests, such as the preliminary tests carried out by plant breeders, standardization is undesirable or impossible. Research on the technique of field experiments was recommended and also the establishment of a Standing Advisory Committee of the Imperial Council of Agricultural Research to co-ordinate work on this class of research. Recommendations were made for obtaining greater uniformity in the methods of testing new sugar-cane varieties.

In the discussion of the proposed bureau of plant introduction, numerous speakers testified to the value of such an institution, references being made to the work of similar organizations in the U.S.A. and U.S.S.R. As defined in a resolution passed, the functions of the bureau would be to facilitate the controlled imports of new species and varieties of crop plants and other plants of economic importance, to assist explorations as and when required in India and other countries and to investigate methods of securing control of plant introduction. A further resolution on this topic, which was also passed, was to the effect that the Imperial Council of Agricultural Research may be invited to formulate a scheme for giving effect to these proposals.

FIELD TESTS 631.421

390. SMITH, H. F. 631.421

Comparison of agricultural and nursery plots in variety experiments.

J. Coun. Sci. Industr. Res. Aust. 1936 : **9** : 207–10.

The author reviews the literature, and adds an experiment of his own, on the question whether small "nursery" plots are a fair representation of varieties of agricultural crops in yield and other characteristics. He has found no evidence of any significant difference between the yields of such small plots and the yields, reduced to the same basis, of larger plots. The data examined statistically relate to a test of wheat varieties in $\frac{1}{100}$th acre plots, and in square yard plots. For yield of grain and number of ears per square yard little difference was shewn, although there was a sign of divergence in the average weight of grain, traceable to a particular variety. J. W.

391. CORNISH, E. A. 631.421:519.24

Non-replicated factorial experiments.

J. Aust. Inst. Agric. Sci. 1936 : **2** : 79–82.

An example is given in which the working out of an agricultural experiment of complex factorial design without replication is made possible by utilizing the high-order interactions to furnish an estimate of the experimental error. A check on the suitability of the method is furnished by comparing the results with those obtained from a second replication of the treatments. J. W.

392. LENNOX, C. G. and MANGELSDORF, A. J. 631.421:633.61

Plot technique in the testing of sugar-cane varieties.

Proc. 5th Congr. Int. Soc. Sug. Cane Tech. Brisbane 1935 : 280–85.

The problem is considered of the size and arrangement of field plots to be devoted to a comparison of new seedling varieties of sugar cane with a standard. Larger plots are needed than in the case of sugar beet or small grain crops, and if these are conceded, competition may not be an important factor. The important thing is to obtain reliable comparative estimates of the yield of seedling and standard in addition to securing through replication an estimate of the experimental errors. For this reason the authors prefer an arrangement of, say, six replications of a set of 11 plots, each set consisting of five seedling varieties arranged at random except that each pair is separated by a standard, to an arrangement of, say, 11 replications of a block of five seedling varieties and one standard, duly randomized. In the former case a close comparison between seedling and neighbouring standard can be made.

J. W.

393. Sayer, W. and Iyer, P. V. K. 631.421:633.61
On some of the factors that influence the error of field experiments with special reference to sugarcane.
Indian J. Agric. Sci. 1936 : **6** : 917–29.
A description is given of an additional uniformity trial on sugar cane, supplementing the author's previous experimental work. Plots numbering 968, of 1/242 acre, each 60 feet x 3 feet were considered, and analysis of the yields shewed that the percentage variation was diminished by increasing the plot size up to 1/27 acre. For convenience, any size between 1/27 acre and 1/16 acre is recommended. As regards shape, it is an advantage to have the length five to fifteen times the breadth. For land of average variability, six to nine replications will give an experiment with a satisfactorily low experimental error. J. W.

394. Sayer, W., Vaidyanathan, M. and Iyer, S. S. 631.421:633.61(54.1)
Ideal size and shape of sugarcane experimental plots based upon tonnage experiments with Co. 205 and Co. 213 conducted in Pusa.
Indian J. Agric. Sci. 1936 : **6** : 684–714.
With a view to securing information relating to the ideal method of lay-out of field experiments with sugar cane, two uniformity trials were conducted. The principal results are obtained from the second of these. Individual yields from approximately 1,000 plots of size 60 feet x 3 feet = 1/242 acre were obtained. Consideration of the way in which the coefficient of variation altered as the size of unit plot increased suggested a satisfactory size between 12/242 and 16/242 acre. Such a plot should preferably be long and narrow, the ratio of length to width being at least 6·7. From the point of view of efficiency in the use of land the smallest plot-size is the most efficient, but, provided the plot is sufficiently narrow, the efficiency was not appreciably lowered for plots of the same shape as the size increased. Division of the area into blocks was considered essential in reducing the experimental error, and, on the assumption of five treatments per block, a plot size between 12/242 and 20/242 acre was found to be effective in enabling an appreciable amount of soil variability to be eliminated between blocks. Border effect was significant, but competition between rows negligible. The Latin square arrangement was found more efficient than that of randomized blocks unless the latter provided at least five or six replications. Four replications of plots 120 feet x 18 feet (12/242 acre) brought the coefficient of variation down to 2 per cent. The extent of land necessary was practically one acre for five plots of this size per block, and it is concluded that a plot unit of this size and shape is eminently suitable for a field experiment on un-irrigated sugar cane. J. W.

PLANT DISEASES 632

395. 632.3:576.16:635.659
Wilson, R. D. 632.3:575.242
A bacterial disease of snake beans.
J. Roy. Soc. N.S.W. 1936 : **69** : 215–23.
The morphological and cultural characteristics of the pathogen, provisionally termed *Bacterium syringae*, attacking the snake bean were studied, and the occurrence of a "rough" strain that arose as a mutant from the normal "smooth" form is recorded.

396. Georgi, C. D. V., Lambourne, J. and Teik, G. L. 632.951.1:581.192.6:575.42(91)
Preliminary selection experiments with Derris.
Malay. Agric. J. 1936 : **24** : 374–89.
The variation in ether extract and rotenone content was studied in random samples of the following types of Derris: *D. malaccensis* var. *sarawakensis*, *D. elliptica* (Sarawak creeping), *D. elliptica* (Serdang type), *D. polyantha* (?), *D. elliptica* (Singapore type) and *D. malaccensis* (Kinta type). Selections for vegetative propagation were made on the basis of ether extract. The Sarawak creeping and Singapore types of *D. elliptica* were best in this respect.

397. 633–1.531.12(71)
633:581.162.3

Canadian Seed Growers' Association.
Annual Report 1935–1936 : Pp. 110.

The report contains a number of separate articles on matters relating to seed growing, including accounts of the recommendations from the Dominion Conference of Plant Breeders to the Canadian Seed Growers' Association, an article by L. H. Newman describing in some detail the origin and development of the Association, other articles describing different aspects of its work and a simple account of pollination and fertilization by W. H. Wright.

398. THADANI, K. I. 633–2–1.521.6:575(54.7)
Some notes of the incidence of disease and resistance to pathological and other adverse conditions in crops of Sind.
Proc. Indian Acad. Sci. 1936 : 3 : Sect. B : 470–80.

The occurrence of varietal resistance and its utilization in breeding resistant varieties is indicated in the following crops: cotton, in relation to jassid, leaf crinkle and the complex of factors causing a reduction in stand; sorghum, in relation to long smut (*Tolyposporium filiferum*) and stem borer (*Chylo simplex*); rice, in relation to "rati" (brown spot—*Helminthosporium oryzae*), sterility and "kalar".
The question of frost-resistant varieties of wheat and oil crops is also discussed.

CEREALS 633.1

399. 633.1:575(94.5)
633.1–2.451–1.521.6:575

Cereal breeding and development.
Guide Book St. Res. Fm Werribee 1936 : 11–21.

Cereal breeding forms one of the activities of the farm.
The objectives in wheat breeding are yield, resistance to flag smut (*Urocystis tritici*) and loose smut (*Ustilago tritici*) and milling and baking quality. In connexion with the work on yield, census studies are made on varietal differences in the factors contributing to yield.
In oats the chief aim has been the production of prolific, drought-resistant varieties suitable for hay or grain and also the breeding of varieties suitable for early green feed. In addition, attention is paid to resistance to loose smut (*Ustilago avenae*) and covered smut (*U. levis*) and to milling quality.
The work on barley includes the breeding of two-rowed types for malting and six-rowed types for feed. Earliness, smooth awns and resistance to covered smut (*U. hordei*) and loose smut (*U. nuda*) are characters which receive attention. Malting barleys from England and Czechoslovakia are used in the breeding for malting quality and have been crossed with local varieties and with early maturing Indian forms. Two hybrid generations are grown in a year by supplementing the daylight with electric light.
Variety trials are performed with these three cereals.

WHEAT 633.11

400. CALLAGHAN, A. R., 633.11:575(94)
BREAKWELL, E. J. and 633.13:575(94)
KLOSE, S. R. 633.16:575(94)
Activities at Roseworthy Agricultural College, 1934-35. Part IV. Cereal breeding, experiments and pure seed production.
J. Dep. Agric. S. Aust. 1936 : **39** : 891–906.

In addition to the attention devoted to quality in wheat (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 25) because of its immediate importance, consideration is given in the breeding work to suitability to the environment, drought resistance, early maturity, agronomic value and disease resistance.

The diseases considered are flag smut (*Urocystis tritici*), stem rust, leaf rust, bunt, and to a lesser extent, loose smut. The breeding work is not concerned with take-all (*Ophiobolus graminis*) or leaf spot (*Septoria tritici*). In the work on stem rust the induction of artificial epidemics is to be tried.
Promising lines from advanced generations are sown in drill strips as well as in the hand plots, with a view to obtaining early information on their field behaviour.
Introductions of varieties have been made from other countries.
In the work on oat breeding, selections have been made from some of the common varieties, and systematic hay, grain and grazing trials are held.
In barley, efforts are being made to combine the high malting quality of such varieties as Spratt-Archer, Plumage-Archer and Beavan's Special, with the greater yield and earlier maturity of Prior. There appears, however, to be an association between late maturity and high malting quality. Prolificacy is the main essential in six-row types, but crosses have been made with Prior in an endeavour to produce forms of six-row barley of fair malting quality for overseas requirements.
The work on pure seed production, cereal variety trials and other experiments is also described.

401. WENHOLZ, H. 633.11:575(94)
The improvement of Australian wheat. Milestones in its progress. Parts I and II.
J. Aust. Inst. Agric. Sci. 1935 : **1** : 57–64, 146–55.
An historical survey of wheat breeding in Australia, from the pioneer work of Farrer to the present day.

402. PERCIVAL, J. 633.11:575.127.5:633.11 *Aegilops*:576.312
***Aegilotricum ovata-turgidum*: a fertile species hybrid.**
Ann. Bot., Lond. 1936 : **50** : 427–36.
The morphological features of the parents and fertile amphidiploid hybrid from an *Aegilops ovata* x *Triticum turgidum* var. *iodurum* cross are tabulated, shewing certain characteristics to be dominant, others intermediate and another not found in either parent,viz. fragile axis of the ear breaking easily at each node. In length of glume and grain size the hybrids surpassed the parents. Up to 1935 six generations have been raised, and two well-defined types have segregated out, namely:—
(1) Plants with lax, black-glumed ears, constant in morphological characters, usually quite fertile.
(2) A pale-glumed, dense-eared form also constant in its characters, but usually less fertile than (1).
Though both types were generally fertile, sterile individuals occurred in each generation, and but for considerable variation in this respect the segregates might be regarded as new species.
Continuing the cytological study begun with the F_1 (Cf. "Plant Breeding Abstracts", Vol. I, Abst. 5), evidence was obtained suggesting that reduplication of both the parental sets of chromosomes had occurred in the reproductive cells of some of the fertile F_1 ears, resulting in 56 chromosomes or 28 bivalents in the F_2 pollen mother cells.
The author states that in the somatic cells (root tips) the numbers were 14 in *A. ovata* and *T. turgidum*, and 28 in the amphidiploid hybrid.* Twenty-eight bivalents (mostly acrosyndetic) were found in the pollen mother cells of sterile and fertile ears of both the above-mentioned types of segregates.
Some speculations are offered on the relations between the fertility and pairing in these, and it is thought possible that the segregation into the two types described may be the result of some slight excess of *Aegilops* or *Triticum* chromosomes, the differences not being big enough to cause entire sterility.

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* These, however, are clearly gametic numbers.—*Editor.*

403. 633.11:575.127.5:633.289:576.354.4
633.11:575.127.5:633.14:576.356.5
633.14:575.127.5:633.289:633.11
633.11:575.127.2

KOSTOFF, D.

The genes of *Triticum Timopheevi* Zhuk., *Secale cereale* L. and *Haynaldia villosa* Schur.

Curr. Sci. 1936 : **5** : 67–69.

A preliminary report on an investigation into the relationships between the different genoms.* In the triploid hybrids *T. monococcum* (AA) x *T. Timopheevi* Zhuk. (2n = 28) there were $7_{II} + 7_{I}$ at metaphase I of meiosis, shewing that *T. Timopheevi* carries the A genom. In the tetraploid hybrid *T. Timopheevi* x *T. durum* var. *melanopus* (AABB) 9 10 bivalents were most frequently observed, while in *T. Timopheevi* x *T. persicum* var. *stramineum* 10–12 bivalents were usually observed, though as many as 14 have been seen. These facts and the degree of chiasma formation indicate that the second genom of *T. Timopheevi* is partially homologous to the B genom and is therefore termed β.

Pentaploid hybrids between *T. vulgare* (AABBCC) and *T. Timopheevi* (AA$\beta\beta$) had about the same number of bivalents as those observed in the tetraploid hybrids, indicating that the β genom is not homologous with the C genom (also known as the D or Dinkel genom).

In the hybrid *T. dicoccum* x *Haynaldia villosa* (n = 7), 0, 1 or 2 bivalents occurred, shewing that the V genom of *Haynaldia* is not homologous with A or B. Though more bivalents occurred in the hybrid *T. vulgare* var. Novinka x *Haynaldia villosa* the increase appears to be due to autosyndesis rather than to allosyndesis between the C and V genoms.

In the hybrid *T. Timopheevi* x *H. villosa* 0, 1, 2 and 3 bivalents were observed, but since very often only univalents were observed it is inferred that there is little or no homology between the β and V genoms.

The S genom of *Secale cereale* behaved very similarly to the V genom in crosses with wheat and shewed little or no affinity with the A, B, C or β genoms in crosses with *T. turgidum* (AABB), *T. vulgare* (AABBCC) or *T. Timopheevi* (AA$\beta\beta$).

It was not found possible to produce a viable hybrid of *Secale cereale* x *H. villosa*, but the S and V genoms were brought together by using *T. dicoccum* as a bridge species. The hybrid *T. dicoccum* x *H. villosa* (ABV) was crossed with *S. cereale* (S) and a trigeneric hybrid with 28 chromosomes (ABVS) was obtained. This produced 0 or 1 bivalent, indicating that S is not homologous with V.

404. 633.11:575.42(68.9)
633.11 Reward

Reward wheat.

Rhod. Agric. J. 1936 : **33** : 528–29.

A brief account of the selection of the two strains of Reward wheat grown in Southern Rhodesia. They are very resistant to rust, mature early, yield well and have been shewn by a test on a commercial scale to be of good quality.

405. LOVE, R. M. 633.11:576.356.52:576.354.46

Occurrence of haploid pollen mother cells in a *vulgare* wheat.

Nature, Lond. 1936 : **138** : 589–90.

Two haploid pollen mother cells occurred in a smear preparation of an F_7 plant from H–44 x Reward. One cell contained seven ring bivalents and seven univalents, the other one heteromorphic trivalent, one heteromorphic bivalent, one open bivalent, five ring bivalents and six univalents, which represents much more pairing than is observed in haploid *vulgare* wheats. It is suggested that the two cells probably arose by pre-meiotic reduction.

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* Referred to as "genes" in the original.

OATS 633.13

406. CUNLIFFE, N. 633.13–2.7–1.521.6:575
Studies on *Oscinella frit* Linn. Inheritance of resistance of oats to attack by the fly and the combination of resistance with other characters of agricultural importance.
Ann. Appl. Biol. 1936 : **23** : 822–44.

An account of an attempt to combine the resistance to frit fly of certain Swedish oats with the quality of English oats. Selection was based on resistance under conditions of severe natural infestation, standing power of straw, colour of grain, tiller and panicle production, size and character of panicle, thousand-grain weight, percentage of husk in grain, fineness of straw, date of exsertion of panicle and capacity for recovering from frit fly attack. The selection No. 3173 from the cross Spet x Star was found to possess the characters required; its resistance is intermediate between that of its resistant parent, Spet and its susceptible parent Star, while its yield of grain is about the same as Victory.

MAIZE 633.15

407. 633.15:575.42(68)
BERG, D. J. VAN DEN 633.15–1.531.12
Production of seed-maize in South Africa.
Fmg S. Afr. 1936 : **11** : 297, 302.

Criteria are given for the selection of maize plants from which seed should be taken.

BARLEY 633.16

408. 633.16:581.46:575
Visit to Dr E. S. Beaven's barley nursery.
J. Inst. Brew. 1936 : **42** : 405–06.

Among the plants seen were three F_1 individuals from the cross Naked six-row x F 112 (*Hordeum hexastichum*) made in 1935. It is hoped to develop a new variety of naked barley, existing races having weak straw and giving poor yields. The new variety is to replace pearl barley in making barley water and breakfast foods.

MILLETS AND SORGHUMS 633.17

409. RANGASWAMI AYYANGAR, G. N. and
HARIHARAN, P. V. 633.171:581.46:575.11
Bristled cumbu (pearl millet).
Madras Agric. J. 1936 : **24** : 235–37.

Pennisetum echinurus, an African species, has very bristly heads. In a cross with *P. leonis*, in which the bristles are suppressed, the F_1 was bristly and in F_2 segregation occurred with a wide range of bristly forms and non-bristly forms. Grouping all the bristly forms together, a ratio of 3 bristly : 1 non-bristly was obtained.

Although the long bristles protect the millet from the depredations of birds, they are accompanied by excessive shedding and a reduction in the number of grains and so are not likely to be of great economic importance.

410. RANGASWAMI AYYANGAR, G. N. and
HARIHARAN, P. V. 633.171:581.466:575.113.3.061.6
The occurrence and inheritance of yellow coloured anthers in the Italian millet. *Setaria italica* (Beauv).
Madras Agric. J. 1936 : **24** : 151–52.

The anther colours brownish-orange and white in *Setaria italica* are known to be allelomorphic characters, brownish-orange being dominant. A further colour, yellow, has been discovered in three varieties. This has proved to be recessive to brownish-orange and dominant to white, giving monofactorial segregation in F_2 in each case.

411. Rangaswami Ayyangar, G. N., Hariharan, P. V. and Rajabhooshanam, D. S. 633.171–1.557:519.241.1
The relation of some plant characters to yield in cumbu—*Pennisetum typhoides* (Burm.) Stapf and Hubbard—the pearl millet.
Madras Agric. J. 1936 : **24** : 203–09.
In six rain-fed varieties of pearl millet total yield of grain per plant was found to shew a high correlation with number of ear-heads and low but significant correlations with height of the main axis and number of nodes in the main axis. The average yield per head was correlated with the yield of the main head, which in turn was correlated with the length, diameter and surface area (length x diameter) of the head, the thickness of the peduncle and the height of the main axis, but not with the length of the peduncle.
The yield of the main earhead can be fairly well predicted from its diameter, length, thickness of peduncle and height of main axis.

412. Rangaswami Ayyangar, G. N. and Nambiar, A. K. 633.174:575.11.061.6 633.174:575.242
Inheritance of characters in sorghum—the great millet. VIII. A brownish purple mutant.
Indian J. Agric. Sci. 1936 : **6** : 481–83.
A mutant found in the variety Periamanjal shewed brownish-purple lines on internodes and leaf-sheaths and possessed brownish-purple mid-ribs. In crosses with the mother variety it behaved as a simple recessive. The pigment was non-anthocyanic. B. P. P.

413. Sabnis, T. S. 633.174:575.42:575(54.3)
Studies in Indian millets. The types of *jowar* isolated at the Government Research Farm, Cawnpore.
Agric. Live-Stk India 1936 : **6** : 506–16.
In tabular form botanical descriptions are given of 63 types of jowar (*Andropogon Sorghum*) and their heads are illustrated by photographs. The types have been isolated by selfing from samples of jowar obtained from different parts of the United Provinces and other parts of India.
Types 5, 19, 23, 46 and 47 have been selected to replace the local varieties.

414. Rangaswami Ayyangar, G. N., Sankara Ayyar, M. A., Panduranga Rao, V. and Kunhikoran Nambiar, A. 633.174:581.44:575.11 633.62:581.44:575.11
Mendelian segregations for juiciness and sweetness in sorghum stalks.
Madras Agric. J. 1936 : **24** : 247–48.
Data are given to illustrate monofactorial segregation for pithy (*D*)—juicy stalks (*d*) and not sweet (*X*)—sweet (*x*) and also independent segregation of the two factors in dihybrid segregation.

415. Rangaswami Ayyangar, G. N. 633.174:581.48:575.116.061.6
Linkage between the blackish purple of sheath and glume, and nucellar brown in sorghum.
Curr. Sci. 1936 : **5** : 200–01.
In many African sorghums a brown colour is produced in the grain by pigmentation in the nucellar layer, a condition genetically determined by a single dominant factor. This factor shews linkage with the factor $Q - q$ for colour of leaf-sheaths and glumes. Almost all the varieties with brown nucellar layer have blackish purple (*q*) leaf-sheaths and glumes.

416. 633.18:575(88)
CODD, L. E. W. 633.18:575.11
Rice breeding, 1933-36.
Agric. J. Brit. Guiana 1936 : **7** : 115–28.

Prior to 1931, breeding was performed by ear-to-row selection, the varieties Demerara Creole (long grain), Blue Stick (medium grain) and No. 79 (medium grain) being produced by this method. Hybridization has been employed since then in the production of high-yielding forms with the different types of grain, Carolina, Seta Patna and medium. Two generations are raised each year.

A list is given of the varieties selected locally or introduced which have come under trial since 1932.

The local varieties appear to belong to at least two distinct strains, the higher yielding types being apparently of Indian origin.

Inheritance studies have been made during the course of the breeding work. Quantitative characters are controlled by multiple factors, but no theory is advanced as to their working. In the cross between Mexican Edith and Demerara Creole a negative correlation was observed between resistance to lodging and yield, while there was some positive association between tillering power and yield per plant and between length of growth period and yield per plant. The inheritance of anthocyanin pigmentation is more clear cut and appears to depend on a basic factor and different localizing genes. A common pattern consists of pigmentation of the apiculus, stigma and axil; in the crosses Blue Stick (non-pigmented) x No. 79 and A 16.34 (non-pigmented) x Demerara Creole this pattern behaved as a unit, giving a segregation of three pigmented : 1 non-pigmented in F_2. More complicated cases occur in which a series of different patterns are obtained in F_2, in different mono- and dihybrid ratios. The non-anthocyanin pigments of the inner glumes, varying from light gold to dark brown, behave as simple recessives to the normal straw colour. Roughness of leaf is always associated with roughness of husk and behaves as a simple dominant to the smooth condition.

In future breeding work special attention is to be devoted to the evolution of forms of the Seta Patna class suited to the particular requirements of the different districts of the colony.

417. DASH, J. S. 633.18:575(88)
The rice industry—a general review.
Agric. J. Brit. Guiana 1936 : **7** : 67–72.

One of the activities of the British Guiana Department of Agriculture in connexion with rice is the breeding of new pure strains, which is now carried on by hybridization and selection, the main criteria being yield, quality, stiffness of straw and freedom from shattering. There are no important diseases of rice in the colony. Attention is largely concentrated on the long and medium grained rices, but a certain amount of work is also done on the plumper, Carolina type.

The organization for the distribution of pure lines is also briefly described.

418. HAIGH, J. C. and FERNANDO, W. N. 633.18:575.11
Notes on the inheritance of characters in paddy (*Oryza sativa* L.).
Ceylon J. Sci. 1936 : **12** : Sect. A : 109–19.

Among the characters studied in the course of general work on the improvement of rice were colour of testa, glume and plant, awnedness and earliness. Some of the results obtained differed from those of other investigators.

Red testa and light glume behaved as simple dominants to white testa and dark glume respectively.

No completely satisfactory explanation of the ratios for plant colour could be obtained, but it is assumed to be conditioned by a basic factor, and one or more supplementary factors determining the intensity.

The study of awnedness was complicated by the fact that this character behaved as a recessive in F_1 and as a dominant in F_2 and by the possibility of a factor affecting the awns being present in the awnless parents without being manifested. Possible environmental effects may, it is thought, also be operating.
In two crosses lateness appeared to be completely dominant to earliness.

419. Nandi, H. K. 633.18:576.312.34:576.354.4:576.356.5
The chromosome morphology, secondary association and origin of cultivated rice.
J. Genet. 1936 : **33** : 315–36.
In 14 varieties of *Oryza sativa* 24 somatic chromosomes were found. The morphology of these was studied, and it was found that the haploid set could be designated thus: A, A_1A_1, BB, B_1, C, C_1, D, D_1, E, E_1; it consists therefore of two groups of five, each group having one chromosome reduplicated.
The early stages of meiosis in the anther followed the normal course, contraction of the chromosomes and terminalization of the chiasmata occurring until at diakinesis the chromosomes were paired by terminal or nearly terminal chiasmata. Two bivalents were regularly attached to the nucleolus, corresponding to two pairs of chromosomes carrying satellites in the somatic cells.
Secondary pairing was observed at metaphase I, the maximum association seen being two groups of three and three groups of two. The number of secondary associations observed per metaphase plate ranged from none to five, four being the mode.
The arrangement of bivalents on the plate, as seen in polar view, corresponded with the stable arrangements of floating magnets as described by Kuwada, secondarily associated groups acting as units.
The same types of secondary association as were observed at metaphase I were also observed at metaphase II.
O. officinalis Wall. was found to have 24 somatic chromosomes, which were somewhat larger than those of *O. sativa*. Twelve bivalents were formed at metaphase I of meiosis, but secondary association was less marked.
O. minuta shewed 48 somatic chromosomes and 24 bivalents at meiosis, with frequent secondary association. Approximately 24 large and 24 small chromosomes could be distinguished at metaphase I.
Discussing the results in relation to the possible polyploid nature of rice, it is pointed out that they support the hypothesis that *O. sativa* is a secondarily balanced polyploid on a base number of five. This is supported by the genetical evidence and by one observation of a quadrivalent at diakinesis.

420. Ramiah, K. and Parthasarathi, N. 633.18:581.143.031:575.243:537.531
An ageotropic mutation in X-rayed rice.
Curr. Sci. 1936 : **5** : 135–36.
Dry seeds of the pure line Co.4 were treated with X-rays. In the second generation a prostrate plant was found, and in the seedlings raised from it both erect and prostrate plants occurred in a ratio of 3 prostrate : 1 erect. Experiments in which the prostrate plants were grown in different positions shewed that they were indifferent to gravity. The mutant character is therefore similar to "lazy" in maize (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1247). The response of the prostrate plants to light is to be tested.

421. Haigh, J. C. 633.18:581.162.32
A note on the natural cross-pollination of rice in Ceylon.
Ceylon J. Sci. 1936 : **12** : Sect. A : 121–22.
Using the dominance of red testa over white as an indicator for hybrid rice plants, experiments on natural cross-pollination of rice were made with seedlings of *mawi* B–11 (red testa) and *sudumawi* P–9 (white testa), planted in such a way that each "white" was completely

surrounded by "reds." The percentage of hybrid plants out of a total of 3087 F_1 plants from the "whites" was 2·43.
Variations might, however, be expected according to the variety used or the weather conditions.
In contrast to the findings of Lord, light glume was found to be dominant to dark, and awn character is apparently more complicated in some cases than has been supposed (Cf. "Plant Breeding Abstracts", Vol. II, Abst. 538).

422. 633.18:581.48.01
TIN, U. 633.18:581.48.02
Developmental variation in the paddy grain.
Indian J. Agric. Sci. 1936 : **6** : 396–459.
The variation in grain size within a panicle and between panicles of the same plant, differences in variability between different strains of the same class and between pure lines of different classes and the effect of certain environmental factors on grain dimensions were studied.
It was found that within a panicle, grain length diminishes from the top to the bottom, and that grain length may differ significantly between panicles of the same plant. The extent to which pure lines may vary was itself a variable character. Different varieties reacted differently to environmental factors.

423. KADAM, B. S. 633.18–2.183–1.521.6:575.11
Genic analysis of rice. I. Grain shedding.
Proc. Indian Acad. Sci. 1936 : **4** : Sect. B : 224–29.
Previous literature on the shedding of the grain in rice is noted.
In the present experiments shedding was studied in a cross between local wild rice from the Karjat district and an improved Burmese variety Paungbalaung 3. The results from three generations indicate that the shedding character of the wild rice is completely dominant to the non-shedding character of Paungbalaung 3 and that the difference is due to two duplicate genes Sh_1 and Sh_2, the wild type rice being $Sh_1Sh_1Sh_2Sh_2$ and the Burmese variety bearing the corresponding recessives.

424. 633.18–2.484–1.521.6:575.12
RAMIAH, K. and RAMASWAMI, K. 633.18:537.531
Breeding for resistance to *Piricularia oryzae* in rice (*O. sativa*).
Proc. Indian Acad. Sci. 1936 : **3** : Sect. B : 450–58.
Breeding has been in progress at Coimbatore with the object of producing a *Korangusamba* type of rice resistant to *Piricularia*.
From the cross GEB.24 x *Korangusamba* pure breeding strains have been evolved combining the resistance of GEB.24 with the superior agronomic characters of *Korangusamba* and out-yielding the latter even under conditions of low infection. It was not, however, found possible to select strains as late in maturing as *Korangusamba*, and since there has been found a high positive correlation between yield and duration, a cross was made between *Korangusamba* and Co.4, a resistant rice maturing at the same time as *Korangusamba*. The work of selection in the progeny of this cross is not yet complete, but it appears that even better results than those from the preceding cross are likely to materialize.
The inheritance of resistance was different in the two crosses. In the first cross, resistance behaved as a simple recessive character, while in the second, the inheritance was more complex and resistance was dominant, making the work of selection more difficult.
The questions of physiological forms of the parasite, of seasonal and climatic factors and of external and internal characteristics of the host on the reaction of the latter are discussed.
Seeds of *Korangusamba* and Co.4 have been subjected to X-ray treatment and have produced several mutations. Their reaction to *Piricularia* is under study.

ROOTS AND TUBERS 633.4

425. Richharia, R. H. 633.42:575.127.5:635.15
Need for research in India on intergeneric crosses between *Brassica* and *Raphanus*.
Curr. Sci. 1936 : **5** : p. 228.
A brief account of the importance of intergeneric crosses between *Brassica* and *Raphanus* from the economic and theoretical points of view.

426. Raw, A. R. 633.491:575
Some aspects of plant breeding—potato improvement.
J. Dep. Agric. Vict. 1936 : **34** : 381–85.
The first of a series of articles on the advances that have been made in the breeding and improvement of the various crop plants.
The early history of potato improvement, aims and methods, the disease problem, Russian work on new species and the present position are shortly outlined.

427. Ritchie, T. F. 633.491:575(71)
The potato in Canada.
Publ. Dep. Agric. Can. 1936 : No. 483 : Pp. 57.
The bulletin includes varietal recommendations for the different regions of Canada, instructions for raising potatoes from true seed, classification of varieties and descriptions of the varieties which have yielded best on the Dominion Experimental Farms and Stations in Canada.

FIBRES 633.5

428. Coulson, A. F. W. 633.51:575:677.1(73)
Recent developments in the methods used to produce the American cotton crop.
J. Text. Inst. Manchr. 1936 : **27** : P249–P274.
In a section on cotton breeding it is suggested that much of the breeding performed in the U.S.A. is of little value from the spinner's point of view, because of the breeders' lack of knowledge of the fibre properties which are most valuable and their tendency to place most emphasis on agronomic features.
In the breeding work of the United States Department of Agriculture, however, much attention is paid to fibre quality. A fibre-testing laboratory is maintained in Washington where tests are made for staple length and uniformity, bundle hair strength, hair weight per inch, immaturity, neppiness, cleanliness and colour. In a spinning laboratory at Clemson College,S.C. new strains are tested under standard manufacturing conditions. The Department also employs a large number of skilled cotton classers.
The encouragement of one-variety communities is also mentioned.

429. Thakar, B. J. and Amin, K. C. 633.51:575.127.2(54.7)
Interspecific hybridization in cotton.
Poona Agric. Coll. Mag. 1936 : **28** : 19–20.
A list is given of the successful crosses between Old and New World cottons made at the Cotton Breeding Station, Surat. From over four thousand crosses, nineteen mature seeds were obtained from eleven bolls. Of these, thirteen gave hybrid plants, three of which have since died, three failed to germinate and three gave plants of the maternal type.

430. Doughty, L. R. 633.526.2:576.312.34:576.354.4:576.356.5
Chromosome behaviour in relation to genetics of *Agave*. I. Seven species of fibre *Agave*.
J. Genet. 1936 : **33** : 197–205.
The somatic chromosomes of seven *Agave* species of the section *Rigidae* of the subgenus *Euagave* are described. *A. amaniensis*, *A. angustifolia* and *A. Lespinassei* are diploids with

2n = 60, including 10 long and 50 short chromosomes; *A. cantala* is triploid with 90 chromosomes, 15 of which are long; *A. Zapupe* is tetraploid with 110, including 20 long chromosomes; *A. sisalana* and *A. fourcroydes* are pentaploid with approximately 138 and 140 somatic chromosomes, each having 24 long chromosomes.
Meiosis in the diploids was usually regular. The long chromosomes form three to four chiasmata with incomplete terminalization, while the short chromosomes formed an average of 1·3 chiasmata per bivalent. The only irregularities observed were cases of chromatin bridges formed by long chromosomes, indicating crossing-over within a heterozygous inversion.
Trivalents, bivalents and univalents were formed by the triploid *A. cantala* at meiosis, trivalents being more common among the long chromosomes. Chromatin bridges affecting long chromosomes were also observed in this species.
In the pentaploid *A. sisalana* quinquevalents, quadrivalents, trivalents, bivalents and univalents were observed, and here again chromatin bridges affecting the long chromosomes were observed. As far as could be observed, meiosis in *A. fourcroydes* was similar.
Meiosis in *A. Zapupe* and *A. Lespinassei* has not been studied as the material has not yet flowered.
The variation in pollen size, possibly related to chromsome number, was greater in the polyploid than in the diploid species. Germination was very poor in *A. cantala*, which is completely sterile. The other species are partially fertile, *A. sisalana* only under certain conditions.
The meiotic behaviour of the polyploid species is taken to shew that they are autopolyploid. The respective complements of the different species indicate a certain degree of relationship between them, supported by their morphological similarity and by their breeding behaviour.

431. 633.584.3

The cultivation of the cricket bat willow.
Bull. For. Comm. Lond. 1936 : No. 17 : Pp. 55.

In a section entitled "systematy of the cricket bat willow and its allies" the morphology of *Salix alba* var. *caerulea* and of the forms likely to be confused with it is carefully described and a key to this section of the genus is given.

SUGAR PLANTS 633.6

432. 633.61:001.4:575.252
633.61 Uba
633.61 Agaul

What is a cane variety?
Int. Sug. J. 1936 : **38** : 326–27.
The identity of Agaul cane.
Int. Sug. J. 1936 : **38** : p. 340.

In connexion with the article reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 45, Mr Andrewes records that on the Esperanza Estate, Natal, the variety Agaul in 1920 was found to be heavily infected with mosaic, whereas Uba has never been infected there, and suggests that this may be a point of distinction between the varieties.
In the editorial columns it is pointed out that it may be possible for a bud sport to arise, differing only in such a hidden character as disease resistance.

433. Baissac, J. 633.61:575(69.1)

The conditions of cane breeding work in Nossi Bé (Madagascar).
Int. Sug. J. 1936 : **38** : 341–42.

A brief description of the conditions of sugar cane cultivation on the island of Nossi Bé and of the technique employed there in breeding new varieties.
The most important disease is leaf scald, while Pokkah boeng, smut and red rot also occur. Two types of cane are needed, one for irrigated fields and one for the non-irrigated, hilly fields. Crosses are made in the open air, the male arrows being kept in dilute sulphurous acid. An interesting feature in the raising of the seedlings is the use of pots made from the dry sheathes of banana leaves, obtained by splitting open the aerial stems.

The hand refractometer is used in the first year of selection.
Under propagation at present is a selfed seedling from a noble cane of local origin. In general, however, nobilizations of *S. spontaneum* appear to offer most promise. A seedling from POJ 2878 x first nobilized Tabongo has been much used as a male parent in crosses with noble canes.

434. 633.61:575(69.82)
Sixth Annual Report of the Sugarcane Research Station, for the year 1935.
Dep. Agric. Colony of Mauritius 1936 : Pp. 52.
Cane breeding has continued along the lines described in previous reports, the chief aims being a grande saison cane for the present Tanna growing areas, chiefly in the uplands, a petite saison cane for the lowlands and a *Phytalus*-resistant cane for those regions infested with this white grub. Freedom from arrowing is one of the subsidiary desiderata.
An attempt has been made to induce Tanna canes to flower for breeding purposes by allowing first ratoon canes to stand over for 24 months and a fair degree of success has been achieved. The experiment is to be repeated with other non-flowering varieties.
The number of first-trial seedlings has been considerably reduced in the year under review, an analysis of the percentage of seedlings selected from crosses made from 1930 to 1933 having permitted the elimination of populations from crosses which had proved to be unproductive of valuable seedlings.
The only seedling bred by the Station to be released for general distribution to date is M. 108/30, a seedling of P.O.J. 2878 x Uba Marot, intended for *Phytalus* infected districts, owing to its vigorous root system. M. 171/30 and M. 73/30 are promising and will probably be released in 1936.
Minor investigations have shewn that a complete sample from a variety trial gives a satisfactory estimate of the Sucrose % Cane, avoiding the rather tedious method of sampling each plot of the variety separately and taking an average, that a pronounced border effect is to be found in variety trials and that high correlations exist between Sucrose % grms. Juice and Sucrose % Cane on the one hand and between weight of sample and weight of juice obtained on the other.
Data from a number of variety trials held on different estates are given and a list of the crosses made during 1935, which includes crosses between noble canes, interspecific and intergeneric crosses and a few selfings, a total of 356 crosses.
Routine tests for gummosis resistance were carried out as usual on the third trial seedlings, studies on root development have been prosecuted and investigations have been made on the *Phytalus* resistance of different varieties.

435. McIntosh, A. E. S. 633.61:575(72.9)
The British West Indies Central Sugar Cane Breeding Station, Barbados, B.W.I. An account of its history and work.
Trop. Agriculture, Trin. 1936 : **13** : 204–12.
After a brief account of the work of the station (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 368) the routine method of distributing seedlings to the different islands is described. Cuttings of seedlings are sent to the Plant Quarantine Station in Trinidad, and during the time these are in quarantine the seedlings are undergoing further testing in Barbados. At the conclusion of quarantine the Central Sugar Cane Breeding Station notifies the Plant Quarantine Station which seedlings should be sent to the different islands, also supplying each island with notes on the seedlings sent and suggestions as to their location in future fields trials.
A descriptive list is given of the seedlings despatched to date to the Plant Quarantine Station, with notes on some of the seedlings intended for the thick cane areas.
In connexion with the breeding of canes for froghopper areas, fuzz from a wide range of crosses has been sent to Trinidad, where observations are to be made on the nature of resistance to froghopper and whether it is an hereditary character.

436. 633.61:575(94)
VENKATRAMAN, T. S. 633.61:575(92.2)
A visit to the Australian sugar industry and to Java.
Agric. Live-Stk India 1936 : **6** : 265–73.

Mention is made of the breeding work by Government Stations and by the Colonial Sugar Refining Company, including the breeding of disease-resistant canes. The use of Coimbatore canes in Australia is also referred to, in particular Co. 290, in the sub-tropical parts.

Breeding and other experimental work at Pasoeroean in Java has been much curtailed as a result of the contraction of the sugar cane area. P.O.J. 2878 remains the best variety.

437. MCINTOSH, A. E. S. and STEVENSON, G. C. 633.61:581.192:578.081
Investigations into the use of the Zeiss Hand Refractometer. (1) The use of the Zeiss Hand Refractometer in the early stages of sugar cane seedling selection.
Agric. J. Barbados 1936 : **5** : 23–39.

The investigation shewed that the Zeiss Hand Refractometer furnishes a comparatively simple, and, by certain methods, a reliable means of indicating the sucrose content of seedlings for selection work. The methods found most reliable in connexion with the routine of selection in Barbados are described.

438. SORNAY, A. DE 633.61:581.192:578.081
L'emploi de l'échantilloneur de jus de Java dans la sélection des seedlings de canne. (**The use of a juice sampler from Java in the selection of cane seedlings**).
Rev. Agric. Maurice 1936 : No. 88 : 147–49.

A description is given of the "Gempol knife" used in Java for the extraction of small samples of juice for analysis. By replacing the container by a small rubber tube it is possible to obtain a satisfactory reading from the juice of a single cane or seedling. By taking the brix of the mixed sample obtained from 5–10 different canes from each plant more reliable figures on which to base selection will be obtained than those from the method hitherto in use.

439. 633.61–1.421:578.08
KERR, H. W. 631.421:519.24
Report of the Committee on field experimentation.
Proc. 5th Congr. Int. Soc. Sug. Cane Tech. Brisbane 1935 : 244–79.

After an account of statistical methods as applied to field experimentation, leading up to the control of soil heterogeneity by "Student's" method and by the randomized blocks and Latin square methods, details are given concerning the practical applications in the case of sugar cane.

Dealing with the question of number of replications, it is shewn that when great heterogeneity makes a large number of replications necessary, economy can be effected by the use of complex trials.

While a long narrow plot should theoretically be desirable, the introduction of pronounced border effects often makes a compromise necessary. In variety trials it is particularly important to provide guard rows. The disposition of the plots with respect to fertility gradients must also be considered.

In determining plot yields, weighing should be done by hand in the field, or if done on a weighbridge the weight of the truck empty and full should be taken, rather than the average weight of empty trucks.

For determination of sugar content a random sample of about 20 stalks, representative of the several plots of each treatment can be crushed (Cf. also Abst. 440, below).

The random arrangement of plots is desirable to avoid systematic errors.

The problems of the pathologist and entomologist need special treatment.

Repetition of trials in several years is often important, to overcome seasonal effects.

440. Arceneaux, G. 633.61–1.421:581.192
Determining theoretical yields of sugar in connection with sugar cane variety tests on the basis of field sampling and laboratory-scale milling tests.
Proc. 5th Congr. Int. Soc. Sug. Cane Tech. Brisbane 1935 : 568–78.
An experiment in which samples of fifty stalks were drawn in different ways from each of twelve plots of P.O.J. 213 shewed that to obtain a reliable estimate of sugar per ton of cane, the best method was to take the sample at random from the whole area of the plot, and also that it was necessary to use two samples from the whole of the twelve plots.
In the routine method now used in Louisiana, a sample of forty canes is taken at random from each plot after the canes have been cut and stacked. By this method, using the twelve replications provided in the trials, differences of 5 per cent in yield of sugar per cane can be detected, and the results in different trials have been relatively consistent.
In calculating yield of sugar per ton from the experimental milling results a varietal correction factor has to be applied for certain varieties.

441. 633.61–2–1.521.6:575(73)
Rands, R. D., Abbott, E. V. and 633.61–2.8:575.11
Summers, E. M. 633.61–2.483:575.11
Disease resistance tests on sugar-cane seedlings and initial selection procedure in the southern United States.
Proc. 5th Congr. Int. Soc. Sug. Cane Tech. Brisbane 1935 : 484–93.
The resistance of newly-bred Canal Point seedlings to mosaic, red rot, root rot and other diseases of less importance, such as sheath rot, red stripe and pokkah boeng is tested at the United States Sugar Plant Field Station at Houma, Louisiana; the methods used are described or referred to.
Since 1933 complete progenies from the best crosses have been grown in Louisiana for the comparison of crosses and for the beginning of a study on inheritance of resistance to the more important diseases.
A list is given of the percentages of mosaic-susceptible seedlings obtained from a number of crosses. A proportion of susceptible seedlings appeared in noble cane x *Saccharum spontaneum* crosses. In the progenies of the crosses Co. 281 x U.S. 1694 and Co. 281 x P.O.J. 2878 reaction to red rot was independent of reaction to mosaic and of resemblance to the parents. From the former cross, 18 per cent and from the latter 32 per cent of the seedlings were commercially resistant to red rot and resistant to mosaic.

442. Shepherd, E. F. S. 633.61–2.3–1.521.6:575.11
Gumming and leaf scald resistance trials in Mauritius.
Proc. 5th Congr. Int. Soc. Sug. Cane Tech. Brisbane 1935 : 507–11.
A gumming resistance trial was carried out by a method based on the Australian procedure (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1104). The plants used were the original seedlings and were grouped according to their parentage. It was found that the progeny of crosses with *Saccharum spontaneum*, Indian or Gros Cailloux parentage, were nearly all highly resistant. From the cross R.P. 6 x M. 2716 forty-six per cent of susceptible plants were obtained, though both parents are commercially resistant.
The trial is to be repeated with the same crosses to see whether it constitutes a reliable method of estimating the value of crosses in breeding for resistance.
From a leaf scald resistance trial, with varieties whose reaction in the field was known, evidence was obtained that infection of the setts with the cutting knife is not a reliable method.

443. Moutia, L. A. 633.61–2.7–1.521.6:575(69.82)
The sugar cane white grub *Lachnosterna* (*Phytalus*) *smithi* Arrow in Mauritius.
Proc. 5th Congr. Int. Soc. Sug. Cane Tech. Brisbane 1935 : 436–45.
The work of the Mauritius Sugar Cane Research Station is mentioned in connexion with the breeding of a variety with a strongly developed root system highly resistant to the attack of *Phytalus* (Cf. Abst. 434).

444. 633.61–2.8–1.521.6
633.61:581.9
BRANDES, E. W. and MATZ, J. 632.8:576.16
Importance of the virus diseases of sugar cane.
Proc. 5th Congr. Int. Soc. Sug. Cane Tech. Brisbane 1935 : 87–107.

Inter alia, it is shewn that a study of the distribution of the virus diseases in conjunction with the geographic origin of the sugar cane indicates that they have long been in association with the sugar cane. Such long association would be likely to result in the development of resistant forms, an expectation which appears to have been realized in the case of some of the more extensively studied diseases and which consequently encourages the hope that virus diseases may be controlled by breeding.

In the discussion the susceptibility of Natal Uba and of the Indian form of *Saccharum spontaneum* to mosaic in India was mentioned by T. S. Venkatraman.

445. DUTT, N. L., HUSSAINY, S. A. and KRISHNASWAMI, M. K. 633.61–2.8–1.521.6:575
632.8:576.16
A note on the breeding of sugarcane varieties resistant to mosaic.
Proc. Indian Acad. Sci. 1936 : **3** : Sect. B : 425–31.

The reaction of the species and certain of the newer varieties of sugar cane to mosaic is discussed. *S. officinarum* is susceptible, some *S. sinensis* varieties are immune, while others are susceptible but tolerant, *S. barberi* is susceptible but little injured, while *S. spontaneum* includes several forms which are completely immune. A variety of *S. robustum*, 28 N.G. 251 has proved susceptible.

Practically all the resistant canes bred have *S. spontaneum* in their pedigree, though canes of the same parentage may differ in their resistance to mosaic.

Preliminary investigations have indicated that mosaic resistance is at least not entirely due to the number of bristles on the leaves.

The different reactions of certain Coimbatore canes in different parts of India suggest that there may be different races of mosaic.

446. 633.63:575
Selection of suitable varieties. Seed trials at Ramsey.
Brit. Sug. Beet Rev. 1936 : **10** : 49–50.

In an experiment conducted by the Klein-Wanzleben sugar factory, 1,100 plots of sugar beet, representing six replications of nearly 200 varieties, were grown. These were harvested separately, weighed and analysed. Mother beets were saved from those families which performed well, and were taken back to Germany to produce seed.

447. BLEIER, H. 633.63:575.127.2:576.356.5
Breeding problems of sugar beet.
Brit. Sug. Beet Rev. 1936 : **9** : 331–35; **10** : 11, 13–14.

A full English translation of the article reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 245.

448. STORY, H. H. 633.682–2.8–1.521.6:575
Virus diseases of East African plants: VI. A progress report on studies of the disease of Cassava.
E. Afr. Agric. J. 1936 : **2** : 34–39.

The symptoms produced by different types of mosaic are described.

The need for resistant varieties is stressed and different methods by which these might be obtained are discussed. The introduction of exotic varieties has not yielded promising results. Selection among local varieties has given some promise of success, but it is difficult to distinguish between tolerance and resistance. The possibility of crossing with wild South American species of *Manihot* is suggested.

449. 633.71:575(68.9)
581.143.26.03:633.71

Tobacco research.

Rhod. Agric. J. 1936 : **33** : 524–26.

The programme proposed for the Trelawney Tobacco Research Station is outlined. The plant breeding section includes continuation of the improvement of existing varieties by selection, hybridization of promising varieties, genetical studies of special varieties and, to a diminishing extent, introductions.

Vernalization is also to be studied.

450. 633.71:575(72.98)

Annual Report of the Senior Plant Pathologist for year ending 31st December, 1935 (Contd.). Part II. Tobacco research.

Rhod. Agric. J. 1936 : **33** : 485–94.

Breeding work done on tobacco comprised the testing of 16 newly-introduced varieties and field trials of twelve different varieties, further selection of 49 single plant selections from varieties previously grown in Rhodesia, selection in the F_2 generations of the crosses Hickory Prior x Cash, Western x Little Crittenden and reciprocals and selections for smallness of ruffle and high and low nicotine content.

451. Freeman, W. E. 633.71–1.531.12:575.42

Tobacco. An improved method of maintaining an adequate seed supply on large estates.

Published by the Tobacco Board, Port-Louis, Mauritius, 1936 : Pp. 3.

The method, which involves a progeny test, consists in selecting about five of the best plants from a crop, sowing their seeds in separate progeny plots and harvesting seed from the best of these plots. Judgment of the plots may be by eye alone, or if desired the final judgment may be based on the curing and grading of the leaves.

452. Mandelson, L. F. 633.71–2–1.521.6:575(73)

The tobacco-growing industry in the United States of America.

Qd. Agric. J. 1936 : **46** : 143–69.

The present article deals with various diseases and pests of tobacco and mention is made of the development of resistant strains in the United States and of the possible role of nutrition as a factor in susceptibility.

The difficulty of combining high quality with disease resistance and of testing for quality is pointed out, and many years of research are anticipated before this complex problem is solved.

453. 633.72:575(54)

Report of the Commission of Enquiry on the Scientific Department, 1935-36.

Indian Tea Ass. Calcutta 1936 : Pp. 153.

The report covers a wide range of topics, comprising the principles followed in the enquiry, the economic situation of tea and its bearing on research, the field of research on tea growing, past and current research on tea growing, the problem of quality, the field of research in tea quality and manufacture, past and current research on tea quality and manufacture, advisory work, the Tocklai station, the organization and control of the work of the Scientific Department and co-operation in research among tea-producing countries.

In the appendices are given a summary of the replies to the questionnaire sent out by the commission and a list of their meetings and visits.

One of the lines of work which it is strongly urged should be taken up at once is plant breeding. An outline of a programme is suggested, comprising the classification and comparative testing of jats (varieties), the establishment of superior clones from selected plants, followed possibly by the raising of clonal seed from the natural crossing of two such clones, the establishment

of a collection of types and possibly the exploitation of hybridization. Since North-East India is the area from which other tea-growing regions have obtained seed, not much improvement is expected from the introduction of varieties, but the wild or semi-wild teas of Assam and adjoining territories should be examined with the object of finding types possessing features, especially disease resistance, not present in any of the cultivated teas.

454. 633.73 *C. Salvatrix*
633.73–2–1.521.6

SWYNNERTON, C. M. F. and PHILIPSON, W. R. 633.73–1.524.4(67.9)
A new *Coffea* from Portuguese East Africa, with ecological notes on the genus.
J. Bot. Lond. **1936** : **74** : 314–22.

The botanical description of the new species *Coffea salvatrix* is given with notes by the first author on its ecology and natural enemies. The trees are not attacked by *Hemileia vastatrix* or by the large brown-banded coffee stem-boring longicorn, *Anthores leuconotus* Pascoe. The stem appears large enough for successful grafting of *C. arabica* on to it, and it is hoped that it may prove a good stock for the latter species.

The quality of the product from the beans is very bitter and has many undesirable characteristics.

Two other wild coffees from the same region, *C. ligustroides* and *C. Swynnertonii* are described. Both are regarded as worthy of experimental cultivation and the former might possibly be of value in crosses with *C. arabica*.

455. 633.73:575(54.8)

GILLETT, S. 633.73–2.452–1.521.6
Report on a visit to Southern India and Java. Part I. The coffee industry of Southern India.
E. Afr. Agric. J. **1936** : **2** : 60–73.

The report includes a description of the activities of the Mysore Coffee Experiment Station, Balehonnur (Cf. "Plant Breeding Abstracts", Vol. VI, Absts. 381 and 1107).

456. GILLETT, S. 633.73:575(92.2)
Report on a visit to southern India and Java. Part II. The coffee industry of Java (N.E.I.). Conclusions and recommendations.
E. Afr. Agric. J. **1936** : **2** : 149–63.

Part II deals with planting and cultivation in general and with the measures for coffee improvement (including resistance to diseases and pests) adopted by the experiment stations, with an account of the Malang and Besoeki Experiment Stations and the co-operating sub-stations situated on numerous private estates.

A concise account is given of the work done on selection, hybridization of Robusta coffee, grafting and resistance to shot-hole borers (*Xyleborus* species), Arabica improvement, the Conuga selections for intermediate altitudes and problems connected with the biology of flowering and fertility. Most of these problems have already been referred to in annual reports on research in Java which have already been reviewed in "Plant Breeding Abstracts". Finally the application of the methods used in Java and India to conditions in Kenya is discussed, and the great importance of co-operation between the planter and the experiment stations is stressed.

633.73:575.42(67.62)

457. GILLETT, S. 633.73–2–1.521.6
The value of selection work with coffee.
Mon. Bull. Coffee Bd. Kenya **1936** : **2** : p. 170.

A brief account of the aims and difficulties to be overcome in coffee selection for high yield and disease resistance, concluding with an appeal for co-operation between the planter and the Agricultural Department.

458. 633.73:575.42–181:581.47(72.98+67.61)

Notes on robusta coffee.

Proc. Agric. Soc. Trin. Tob. 1936 : **36** : 265–76.

An address on robusta coffee in which the types found in Uganda and in Trinidad are discussed. The importance of seed selection to obtain an increase in bean size was illustrated with reference to results obtained in Uganda where larger beans and berries were obtained by sowing seed from a large-berried tree, even though the male parent or parents were unknown. In addition, the use of seed from selected individual trees was found to reduce the variability of the product. Cultural methods, marketing, etc. were also discussed, (Cf. also "Plant Breeding Abstracts", Vol VI, Abst. 735).

459. McDonald, J. 633.73–2–1.521.6:575

The susceptibility of Harar coffee to disease.

Mon. Bull. Coffee Bd. Kenya 1936 : **2** : p. 191.

Observations have shewn that the Harar seedlings imported into Kenya in 1931 are not proving so resistant to various diseases and pests as was anticipated. Whether there are strains resistant to *Colletotrichum coffeanum* Noack. var. has still to be discovered.

460. 633.73–2.452–1.521.6:575.11

Wilson Mayne, W. 632.452:576.16:633.73

Annual Report of the Coffee Scientific Officer, 1935-36.

Bull. Mysore Coffee Exp. Sta. 1936 : No. 14 : Pp. 21.

Further progress in the work on the inheritance of resistance to leaf disease (*Hemileia vastatrix*) (Cf. "Plant Breeding Abstracts", Vol VI, Abst. 381) has indicated an increase in the complexity of the problem, owing to the discovery of a third strain of the fungus, attacking certain plants which are resistant to strains I and II. There are, however, a large number of plants resistant to all three strains, and it appears that resistance to the third strain occurs commonly among Kents.

The simple one factor inheritance of resistance to strain I has been confirmed, and further evidence has been obtained indicating that resistance to strain II is governed by two factors, one of which is probably the same as that governing resistance to strain I. The inheritance of resistance to the third strain has not yet been studied.

461. Gilbert, S. M. 633.73.00.14(67.8)

Memorandum on coffee research and experimentation.

E. Afr. Agric. J. 1936 : **2** : 30–33.

The need for standardized material, for individual tree records, uniformity trials and knowledge of plot size is stressed, and it is pointed out that this need has been recognized by the Coffee Research and Experiment Station, Lyamungo, Tanganyika, which is now in a position to carry out field experiments. Standardized material will be available in considerable quantity in 1937.

462. 633.73.0015(67.82)

Coffee research in East Africa with particular reference to Lyamungo.

Planter 1936 : **5** : 8–9, 18.

The desirability of extending the region to be served by the Lyamungo Coffee Research and Experimental Station is discussed and the problems and difficulties arising in field experimentation are reviewed by full citations from Technical Communication No. 2 of the Imperial Bureau of Fruit Production.

Data on individual tree records, uniformity trials and data on plot size, all of which are necessary as a preliminary to precise field experiments, are available at the Lyamungo Station.

463. Voelcker, O. J. 633.74:575.42(66.9)
Initial cacao selection in Nigeria.
11th Bull. Agric. Dep. Nigeria 1936 : 45–54.
Nigerian cacao is characterized by uniformity both of tree and bean, the somewhat flattened purple bean contained in the typical yellow Amelonado pod being found almost everywhere. The initial material for selection was a collection of trees on Moor Plantation, Ibadan, whose yields had been individually recorded since 1921. Yield was the primary criterion for selection, though bean weight also has to be taken into account. The selected trees have been selfed and when the progeny are established it is hoped that there will be some 10,000 trees which will be individually recorded. The initial selections already include two trees, Nos. 38 and 9, which are outstanding in yield and satisfactory in regard to bean weight.
Some trees have been noted which produced light coloured beans, up to about 20 per cent, but attempts to self-fertilize these met with failure. Selection for quality must, however, be based on such trees and on introductions.

464. Voelcker, O. J. 633.74:581.162.3
A study of controlled pollination in cacao (*Theobroma cacao*).
11th Bull. Agric. Dep. Nigeria 1936 : 39–44.
Controlled pollinations of yellow Forastero Amelonado cacao over the period March 24, 1931 to March 23, 1932, resulted in a total of 86·0 per cent flowers fertilized and 26·4 per cent mature fruit harvested. Except on certain cold mornings, pollinations were carried out between 8.30 a.m. and 9.15 a.m. The degree of success was not affected by the weather conditions prevailing at the time of pollination.
No mature pods were obtained from pollinations made between August 11 and November 30. The incidence of shedding was different at different times of the year. Thus during the period January 26 and May 18 shedding was continuous among pods of less than fifty days old, pods reaching that age eventually maturing. From May 18 to September 7, on the other hand, there was an interval of about twenty days, beginning after the eighth to the sixteenth day, during which no shedding occurred; after this period shedding occurred again and continued to about the eightieth day.
At all seasons there was heavy shedding during the first eight days after fertilization. Flowers which fell before the fourth day after pollination were considered to be unfertilized.

465. Jackson, F. C. 633.79:575
Hops in 1936.
J. Inst. Brew. 1936 : **42** : 534–36.
The author suggests that much of the time spent in attempts to produce new varieties has been wasted; he has not met with any new variety which is superior to some of the best known old ones.

466. Salmon, E. S. 633.79:575(42)
Nineteenth report on the trial of new varieties of hops.
E. Mall. Res. Sta. Kent 1936 : Pp. 15.
A list is given of new varieties of hops being tested at East Malling Research Station, with indications of their origin and data on their actual and estimated yields, number of bushels required to the cwt. and resin content.
Some of the new varieties, suitable for cultivation in England, are equal or superior in preservative qualities to imported American hops.

TANNING PLANTS 633.87

467. Cheel, E. 633.879:575.127.2
The occurrence of hybrid Acacias.
Proc. Linn. Soc. N.S.W. 1935 : **60** : 443–46.
Records of various interspecific hybrids of *Acacia* and putative hybrids are cited, including one of which the F_1, F_2 and F_3 races were exhibited by the author at a meeting of the Linnean Society of New South Wales in 1933. A bibliography is appended.

MEDICINAL PLANTS 633.88

468. McAulay, A. L., Cruickshank, F. D. and Brett, R. G. 633.88.11.871:576.312.35:576.354.4

Chromosome number of *Eucalyptus globulus* and *Eucalyptus Johnstoni*.

Nature, Lond. 1936 : **138** : 550–51.

The haploid number was found to be eleven in each case. A tendency to secondary association was observed in *E. globulus*.

RUBBER PLANTS 633.9

469. Mann, C. E. T. 633.912:575(91)

Note on preliminary results from the study of seedling trees derived from proved clones.

J. Rubb. Res. Inst. Malaya 1936 : **7** : 102–04.

The yields of dry rubber in pounds per tree per year at 5½ to 6½ years are given for a number of seedlings from controlled and uncontrolled pollinations of five clones. The results confirm the superiority of A 44 as a parent indicated by the test tappings (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 394). While seedlings from controlled pollination are approximately equal in yield to budded trees of the same parent clones in the first tapping year, seedlings from uncontrolled pollination are inferior in yield to buddings at comparable age. Seedlings from uncontrolled pollination of A 44 and B 84, however, gave very promising yields.

Further study will be needed to see whether A 44 transmits its precocity to its progeny.

FRUIT TREES 634

470. 634.25:575.127.5:634.551

A new fruit.

Fruitation 1936 : **1** : p. 364.

A new peach-almond hybrid from Hungary is referred to as being shortly ready for growing on a commercial scale.

CITRUS FRUITS 634.3

471. Wright, N. 634.3:581.163

Additional notes on the seedlessness of citrus fruits.

Trop. Agriculture, Trin. 1936 : **13** : 283–84.

A further discussion on the influence of cross-pollination on the production of seeds in "seedless" citrus fruits.

VARIOUS SMALL FRUITS 634.4

472. 634.41:575
634.412:575.127.2:634.413

Ahmed, M. S. 634.41:581.162.3

Pollination and selection in *Anona squamosa* and *Anona Cherimolia*.

Bull. Tech. Sci. Serv. Cairo 1936 : No. 157 : Pp. 29.

The quality and yield of *A. squamosa* are considered to be less amenable to improvement by selection than by cultural methods, in particular the adoption of a suitable method of hand pollination. The variability of *A. Cherimolia* on the other hand makes it a suitable subject for genetic improvement and bud selection has been started in this species.

Both species are self-fertile and also, to a certain extent, inter-fertile, for natural hybrids occur in mixed seedling plantations. By artificial cross-pollination the author obtained seven fruits from thirty flowers in the cross *A. Cherimolia* x *A. squamosa;* from a similar number of crosses no fruits were obtained in the reciprocal.

NUTS 634.5

473. 634.573:575.42
634.573:581.162

PAUL, W. R. C.

The cashew nut industry of South India.

Trop. Agriculturist 1936 : **87** : 166–73.

In addition to cultural and economic questions relating to the cashew new, observations are included on varietal differences and selection for yield and quality, etc. Selection should not be based on the size of the nut without due consideration of the size of the kernel.

SMALL BUSH FRUITS 634.7

474. CHEEMA, G. S. and BHAT, S. S. 634.771:575(72.98)

Banana breeding at the Imperial College of Tropical Agriculture, Trinidad.

Indian J. Agric. Sci. 1936 : **6** : 484–501.

A summary of the work already reviewed in "Plant Breeding Abstracts", Vol. II, Abst. 372, Vol. III, Abst. 323 and Vol. V, Abst. 588.

FORESTRY 634.9

475. 634.9:016

Forest bibliography to 31st December, 1933.

Published by Dep. Forest. Univ. Oxford 1936 : Pt. I : Pp. 78.

A classified list of the literature published up to the end of 1933 and available in the library of the University of Oxford, Department of Forestry. Books and unpublished and confidential matter are not included.

476. UPCOTT, M. 634.973:575.129:576.312.34

The parents and progeny of *Aesculus carnea*.

J. Genet. 1936 : **33** : 135–49.

Aesculus carnea (2n = 80) is a fertile, constant breeding hybrid between *Ae. Hippocastanum* (2n = 40) and *Ae. Pavia* (2n = 40). According to Skovsted the chromosomes of *Ae. Hippocastanum* are about one-eighth the size of those of *Ae. Pavia* or *Ae. flava*, and this size difference is maintained in *Ae. carnea*, the two groups being distinguishable at the first metaphase of meiosis.

The present author finds that although there is a range of size in each species, the average size is about the same in all of them. The different sizes of the bivalents which Skovsted observed in polar views of metaphase I she attributes to the different number of chiasmata they form and their consequent different shapes.

Secondary pairing and multivalent formation in the parent species indicate that these are actually tetraploid and *Ae. carnea* octaploid. Multivalents are also found, along with varying numbers of bivalents and univalents, in *Ae. plantierensis*, a hexaploid back-cross of *Ae. carnea* on *Ae. Hippocastanum*.

Chromatin bridges, indicating the presence of heterozygous inversions, were found in *Ae. Hippocastanum* and *Ae. carnea*.

VEGETABLES 635

477. 635:575(42)
635.64–2.484–1.521.6:575

Science and the glasshouse industry.

Nature, Lond. 1936 : **138** : p. 556.

In a public lecture with the above title, Dr. W. F. Bewley mentioned the breeding work on lettuce and tomatoes at Cheshunt. Good types of tomatoes resistant to *Cladosporium fulvum* have been obtained, while in lettuce the Cheshunt Early Giant variety represents a notable achievement in that it will produce well hearted lettuce during autumn and winter.

478. 635.25–2.7–1.521.6:575

Measures against onion thrips.

Agric. Bull. Bermuda 1936 : **15** : 70–71.

The use in California of a Persian variety of onion in breeding for resistance to thrips is mentioned (Cf. "Plant Breeding Abstracts", Vol VI, Abst. 660).

479. Levan, A. 635.265:576.312.35:575.12:576.356.5

Different results in reciprocal crosses between diploid and triploid *Allium schoenoprasum* L.

Nature, Lond. 1936 : **138** : p. 508.

Aneuploids were relatively much rarer in the progeny of the cross diploid x triploid and the variety in chromosome numbers was less than in the cross triploid x diploid.

480. Sutaria, R. N. 635.61/3:576.312.35

On the chromosome numbers in some cultivated and wild cucurbits of Gujarat.

J. Univ. Bombay 1936 : **4** : 21–28.

The chromosome numbers reported by previous workers are tabulated with the determinations made by the author for 10 Indian species of the *Cucurbitaceae*. The haploid numbers that have been reported for the family are 7, 10, 11, 12, 16, 20 and 24, to which the writer now adds 14, the haploid number in *Momordica dioica*. *M. Charantia* has, however, 11.
Some cytological particulars are given and revision of the genus *Luffa* is suggested.

481. Hadfield, J. W. and Calder, R. A. 635.64:575.125

Commercialization of hybrid-vigour in the tomato.

N.Z. J. Agric. 1936 : **53** : 139–46.

The term hybrid vigour and its genetic basis are explained and on the basis of the results of reciprocal crosses of four tomato varieties selected at random the utilization of hybrid vigour is shewn to have possibilities from the commercial standpoint.
The technique of crossing tomatoes and the saving of seed are described.

482. 635.64:576.356.5:577.16

Sansome, F. W. and Zilva, S. S. 635.64:581.192

Polyploidy and vitamin C.

Bio-chem. J. 1936 : **30** : 54–56.

In reply to a criticism of the authors' findings (Cf. "Plant Breeding Abstracts", Vol. IV, Abst. 891) provisional experimental data are cited suggesting that fruit size was not a significant factor in controlling the concentrations of ascorbic acid in polyploid and diploid tomatoes respectively. A tentative explanation of the variation found in the difference between these two genetic types of tomatoes is offered pending further investigation.

483. Ramanatha Ayyar, V. and Balasubramaniam, R. 635.657:581.48:575.11.061.6

Inheritance of certain colour characters in gram (*Cicer arietinum*).

Proc. Indian Acad. Sci. 1936 : **4** : Sect. B : 1–26.

The inheritance of the flower colours pink, blue and white was found to be governed by three factors, two complementary factors *C* and *B* which together produce blue and a factor *P* which converts blue into pink. In the absence of *C* or *B* the flowers are white.
The factor *C* has no effect on seed colour, which was affected by *B*, *P* and three other factors, F^r, T^1 and T^2. The colours they produce in the different combinations studied are as follows, the names being derived from Ridgway's "Colour standards and nomenclature": warm buff $bpf^rt^1t^2$ or $bPf^rt^1t^2$, pale ochraceous salmon $bpF^rt^1t^2$ or $bPF^rt^1t^2$, pinkish cinnamon $bpf^rt^1T^2$ or $bPf^rt^1T^2$, light pinkish cinnamon $bpF^rt^1T^2$ or $bPF^rt^1T^2$, dark olive buff $Bpf^rt^1t^2$ and $BpF^rt^1t^2$,

buffy brown $Bpf^{r}t^{1}T^{2}$ or $BpF^{r}t^{1}T^{2}$ or $Bpf^{r}T^{1}T^{2}$, pinkish buff $BPf^{r}t^{1}t^{2}$, cinnamon buff $BPF^{r}t^{1}t^{2}$, cinnamon $BPf^{r}t^{1}T^{2}$, Sayal brown $BPF^{r}t^{1}T^{2}$, Roods brown $BPf^{r}T^{1}T^{2}$, vandyke brown $BPF^{r}T^{1}T^{2}$. Certain of these factors also affect the size and shape of the seeds and the texture of the seed coat. Thus *B* in conjunction with *p* reduces the size and gives the seeds a round shape. F^{r} also produces round seeds, but is hypostatic in the presence of *Bp*; it also produces a puckered surface, an effect which is much reduced in association with *B* and *P* or *B* and T^{2}.
All the factors studied shew dominance and are inherited independently of each other.

484. Ramanatha Ayyar, V. and Balasubramania Iyer, R. 635.657–2.484–1.521.6:575.11
A preliminary note on the mode of inheritance of reaction to wilt in *Cicer arietinum*.
Proc. Indian Acad. Sci. 1936 : **3** : Sect. B : 438–43.
The F_2 and F_3 data from a cross between a susceptible and a resistant strain suggest that resistance to *Fusarium* wilt is governed by a single factor with incomplete dominance. Resistance was inherited independently of seed-coat colour and degree of branching and is associated with the development of a thick layer of suberin in the cortex of the root.

485. Pal, B. P. 635.657–2.7–1.521.6:581.446.1
A note on the relation between the internal stem structure of certain varieties of gram (*Cicer arietinum* L.) and their resistance to cutworm attack.
Proc. Indian Acad. Sci. 1936 : **3** : Sect. B : 527–34.
Varietal resistance to cutworm (Noctuid larvae) attack was found to be associated with well-marked development of the secondary xylem at the base of the stem. It is suggested, therefore, that selection for this character might be a control measure against the pest.

486. Shaw, F. J. F. 635.659–2.484–1.521.6:575
Studies in Indian pulses. The inheritance of morphological characters and of wilt-resistance in rahar (*Cajanus indicus* Spreng.).
Indian J. Agric. Sci. 1936 : **6** : 139–87.

Shaw, F. J. F.
The inheritance of morphological characters and of wilt resistance in rahar (*Cajanus indicus* Spreng.).
Proc. Indian Acad. Sci. 1936 : **3** : Sect. B : 491–92.
In a cross of Type 80 (resistant) x Type 5 (susceptible), resistance to wilt was found to be inherited independently of flower colour, erect or spreading habit of growth, short or tall stature of plant, crowded or open inflorescence and brown or grey markings of the seeds.
In Type 5 red colour on the dorsal side of the standard is absent, whereas in Type 80 diffused red colour is present. In the F_1, the dorsal side of the standard had faint lines, while in F_2 a new type called "ringed" was produced, characterized by the possession of red dots on the margin of the dorsal side of the standard. The erect habit of Type 5 was partially dominant to the spreading habit of Type 80, and the short stature of the former type completely dominant to the tall stature of the latter. Monofactorial segregation was observed in the F_2 in the case of both pairs of characters. The crowded inflorescence of Type 5 was dominant to the open inflorescence of Type 80 on a 3 : 1 ratio. In the case of seed colour, although a monohybrid ratio was obtained, the inheritance of this character was suspected to be more complex. The losses due to wilt in F_2 suggest that wilt resistance is probably controlled by two or three factors. The F_2 and F_3 generations were grown both in fields which had been artificially infected and in fields which were not artificially infected. The ratios of the various phenotypes in F_2 in the artificially infected fields were not disturbed by the incidence of the disease, indicating that the inheritance of resistance was not linked with any of the morphological characters studied.
B. P. P.

Part II. Foreign

STATISTICS 519

487. KRISTENSEN, R. K. 519.24
Middelfejlen paa de udlignede Forsøgsresultater ved Markforsøg. (**The mean error in the adjusted experimental results in field experiments**).
Nord. JordbrForskn. 1936 : Nos. 3–4 : 286–91.
Formulae are worked out for the mean error to be applied to the total yield of all the replicate plots of any one treatment in a field trial of the systematic nature, where a number of treatments are repeated a number of times. Account is taken of the fertility gradient across the plots, provision being made for border plots in this connexion. J. W.

488. ROESSLER, E. B. 519.24
Significant figures in statistical constants.
Science 1936 : **84** : 289–90.
The following working rule is suggested: in a final published constant retain no figures beyond the position of the first significant figure in the standard error; keep one more place in all computations.

489. WISHART, J. 519.24(51)
Statistics in Chinese agricultural research.
J. Amer. Statist. Ass. 1936 : **31** : 127–28.
A brief account is given of the statistical section of the agronomy department of the National Agricultural Research Bureau, situated at Shao-ling-wei, outside Nanking.

490. TEDIN, O. 519.24:631.421
Einige Gesichtspunkte zur Benutzung der Statistik im Versuchswesen. (**Some points of view on the use of statistics in experimental work**).
Züchter 1936 : **8** : 185–87.
The author contributes to a set of articles commemorating the jubilee of the Svalöf Plant Breeding Station, a critical account of the way in which the theory of statistics has been used in the planning and analysis of results of field experimental trials. He refers particularly to the work of Fisher in devising new methods based on the analysis of variance, and concludes with a brief mention of "confounding" in the case of experiments involving multiple factors.
J. W.

491. WANG, C. M., CHANG, W. H. and TANG, C. H. 519.241:633.11–1.557
(**A study on the partial correlations between yield and other quantitative characters in wheat**).
J. Agric. Ass. China 1935 : No. 142–143 : 49–68.
Fifty observations were made on each of the six characters –(1) weight of seeds, (2) weight of stems, (3) weight of total plant, (4) length of stems, (5) number of ears, and (6) the mean weight of ear for each plant—for each of twenty strains of wheat in three consecutive years. It was found, by the method of analysis of variance and covariance, that the total correlations between any two characters were significant except in the case of the sixth with the second, fourth and fifth. After eliminating the effects due to years and strains only those between the first characters and the second, third and sixth; between the second and third, and between the third and the sixth were significant. Of the five fourth order partial correlations with regard to the weight of seeds calculated from the total correlations, only those with the third character ($r = \cdot5041$) and the sixth character ($r = \cdot44449$) were significant. It was also found that, calculated from the residual correlations, the second order partial correlation between the first and sixth (eliminating the effect of the second and third) was also significant with $r = \cdot5579$. The experiment is still being carried on but the arrangement has been changed to randomized blocks since 1935. P. C. T.

492. 575:633

Förädlingsarbetena och genom förädlingen uppnådda resultat. (**Breeding work and the results thereby attained**).

Sverig. Utsädesfören. Tidskr. 1936 : **46** : 198–309.

In this section of the journal commemorating the jubilee of the Swedish Seed Union, the history of wheat breeding up to the time of the foundation of the Seed Union is briefly reviewed and the results of the pedigree method used by the Union are considered.

After 1900 the use of hybridization as a method of plant improvement was increasingly used and many valuable forms were so obtained. This led to a realization of the importance of cytology in plant breeding and a special department was established in this connexion, the aim being to improve the types, if possible by increasing the chromosome number. Work on induced mutation is also in progress.

The technique used in the field experiments is described as well as the various laboratories connected with the Union.

The work done and in progress on the various cereals, root crops, leguminous forage plants, grasses, oil and fibre plants and hops is reviewed and an account is given of the activities of the sub-stations and their part in the work of the Union.

493. Caty, R. 575:633

L'amélioration des plantes de culture indigène aux colonies. (**Improvement of plants cultivated by the natives in the colonies.**)

Agron. Colon. 1936 : **25** : 34–42, 78–89.

Mention is made of the great variety of forms existing in all locally cultivated crops and the great scope that this gives to the plant breeder for producing improved forms vastly superior in adaptation to any introduced from abroad and superior in quality to the material hitherto grown. Native growers have for centuries practised a sort of selection and this combined with natural selection has served to create a number of highly adapted local types. Yield and morphological characters are mainly neglected by the natives, selection for quality is definitely practised; great variation exists in the first two characters therefore and increases of yield can easily be brought about by selection. It is not usually difficult also to bring about an increase in quality by the same means. By carrying out this selection in each ecologically different region it is possible to create a series of forms ideally suited to each one of these regions. The first step in breeding hence is that of delimiting the ecological zones, followed by the collection of the varieties for each of the separate zones, taking into account any information obtainable from the cultivators respecting the different types. The methods of carrying this out, and of the later purification, selection and testing of the types are described. Any group of forms homogeneous for the main characters examined is regarded as a type and no attempt is made to reach genetical purity. The types isolated are classified as those capable of direct utilization for replacing the forms already cultivated, those possessed of certain desirable characters and suitable for hybridization, and those of no interest whatever, which may if necessary be discarded.

The author recommends making tests first of all of the chemical and physical properties, quality, etc. of the types obtained, so as to eliminate undesirable ones, then testing the industrial properties and finally the agronomic qualities such as yield, resistance, adaptation, etc. The lines so isolated are not pure types, with their attendant disadvantages and limitations, but populations uniform for certain characteristics previously agreed upon. The method has given excellent results with rice in Cochin China and Cambodia and is recommended for other crops.

494. Linke, W. 575:633(43)

Professor Freudl als Pflanzenzüchter. (**Professor Freudl as a plant breeder**).

Bl. PflBau. PflZücht. 1936 : **3** : 58–61.

A eulogy of "the father" of Bohemian plant breeding and his work on cereals, fodder plants, grasses and flax, etc.

495. Schönberg, M. 575:633(43)
Pflanzenbautagung Weihenstephan 1936. (**Weihenstephan Meeting for Plant Culture 1936**).
Forschungsdienst 1936 : **2** : 117–20.
A number of addresses dealing with plant breeding were read.

496. 575:633(44)
Alabouvette, L. 575.42(44)
Organisation générale de l'amélioration et de la sélection des plantes en France. (**General organization of plant improvement and selection in France**).
Sélectionneur 1936 : **5** : 59–70.
A brief historical note on the plant improvement work in France is followed by an outline of the present position and the existing official organization for the promotion of plant breeding investigations both by public institutes and private breeders. The report is arranged under crops and purports to deal with the introduction and production of new varieties, experimental work, multiplication and measures relating to plant patents and the control of seed quality.

497. Brétignière, L. 575:633(44)
Le centre d'expérimentation d'Epoisses. (**The research centre of Epoisses**).
J. Agric. Prat. Paris 1936 : **100** : No. 43 : 284–87.
In 1927 the company of the P.L.M. established a research station for plant breeding at Dijon. This was moved in 1930 to Epoisses a few miles away.
The director is M. Crépin and his first object was to produce wheats suitable for the east and south-east districts of France. These must be high-yielding and resistant to cold and to drought.
P.L.M. I was the first wheat to be produced at the station but it was not suitable for the richer soils. Further crosses have produced the variety Côte-d'Or, now in process of multiplication, high-yielding, very resistant to lodging and to cold.
Crosses are being made in oats to produce a winter variety resistant to lodging.
Potatoes are being bred for resistance to wart and the researches include also barley, clover, lucerne, soya beans, etc.

498. 575:633(47)
Meister, G. K. 63.00.15(47)
History of the development of the Saratov Breeding Station and its main achievements).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 7 : 12–32.
A more concise account of the material presented in the memorial volume reviewed in "Plant Breeding Abstracts", Vol. VII, p. 116.

499. 575:633(47)
Meister, G. K. 63.00.15(47)
(**On what we are working**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 4–5.
Also Izvestija 1936 : 23rd April.
Reference is made to the achievements of the Saratov Breeding Station on the lines of earlier articles (Cf. "Plant Breeding Abstracts", Vol. VII, p. 116). Constant perennial rye-wheat hybrids with excellent grain quality have now been obtained, as well as crosses of *Agropyrum cristatum* with both wheat and rye.

500. 575:633(47)
MEISTER, G. K. 63.00.15(47)
(**The Saratov Breeding Station and its immediate prospects**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 1 : 10–13.
A further reference to the achievements of the Saratov station (Cf. Abst. 498) in which the Director points out that the station does not, as is often supposed, work exclusively with distant hybrids, and complains of inefficiency of the equipment of the station in many respects. An entire reconstruction of the station is planned, to equip it for carrying out its new programme for producing varieties resistant to drought, cold, fungous and insect pests, with improved yield and quality and suitable for mechanical harvesting. In order to accomplish this programme, studies are also made upon the inheritance of all the characters desired.

501. 575:633(48.5)
(1) NILSSON-EHLE, H. 631.531.12(48.5)
Der schwedische Saatzuchtverein in Svalöf. (**The Swedish Seed Breeding Association in Svalöf**).
Züchter 1936 : 8 : 169–74.

(2) A.Z.
Sveriges Utsädesförening, Svalöv, 50 ar. (**The Swedish Seed Breeding Association, Svalöf, Jubilee**).
Skånsk JordbrTidskr. 1936 : Nr. 32 : 499–503.

(3) WACHENFELT, M. DE
Seed breeding in Sweden. Svalöv's 50-years' anniversary.
Anglo-Swedish Rev. 1936 : 347–49.
Three papers written in celebration of the 50 years' Jubilee of the Association and dealing with its foundation, development and present organization and work, including research on the production of new varieties of cereals and fodder plants by hybridization or by increasing the chromosome number or by induced mutation following X-ray treatment. The various developments in the technique of selection are also mentioned, including the use of a freezing laboratory in testing for frost resistance. Brief references are also made to the investigations on baking quality in wheat, malting quality in barley and the suitability of varieties for different regions by means of a system of branch stations.

502. 575:633(65)
633.1–2–1.521.6
Expérimentation agricole. (**Agricultural experimental research**).
Exposé Situat. Gen. Algérie (1935) 1936 : Pp. 61.
Plant improvement work has been concentrated mainly on wheat and barley, with special attention to the problems of yellow berry in hard wheats (Bidi No. 368 and Rouge de Tlemcen) and of rust resistance in certain Florence x Aurore and Florence x Pusa hybrids.
Among the cereals the early two-rowed barley l'Orge d'Italie No. 42 has shewn high resistance to lodging and in brewing quality it is equal to the four-rowed barleys of Algeria, while the black Algerian oat No. 912 seems more resistant to rust than the ordinary red oat of Algeria.
The Agricultural Institute of Algeria has also taken an active part in collaborating in investigations on plant improvement, vernalization, genetic and cytological studies of tendroid forms and on natural hybridization.
Accounts are given of the activities of the various experiment stations and agricultural schools in regard to variety trials, pedigree selection and tests of new cereals and tobacco.

503. 575:633(65)
DUCELLIER, L. 631.531.12
Rapport sur le fonctionnement du Laboratoire d'Agriculture et de la Station d'essais de Semences et d'amélioration des plantes pendant l'année 1935. (**Report on the work of the Agricultural Laboratory of the Experiment Station for Seed Testing and Plant Improvement during 1935**).
Inst. Agric. Algérie 1935 : Pp. 3.

At this Station in addition to seed analysis and the supply of pedigree seed the improvement of cereals has been studied. Certain varieties of hard wheats, which appear to have a low percentage of yellow berry have been discovered, e.g. Bidi No. 368 and Rouge de Tlemcen. The work in progress with hybrid selections of soft wheat and with barleys and their resistance to lodging and disease are briefly mentioned.

504. EICHFELD, I. G. 575:633:551.566.3
(**Breeding for the extreme north**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 20–21.

A potato hybrid combining frost resistance (— 4·2° C.) with the capacity to form tubers in the long day of the arctic circle has now been obtained, though it needs further work in the direction of increasing yield. Veselovskii's triple hybrids *S. tuberosum* x *S. andigenum* x *S. tuberosum* are very promising in respect of yield.
The work on many forage grasses has been facilitated by the discovery of apomictic forms.
In vegetables sufficient improvement can be effected so far simply by selection. Forms with a long thermo- and photo-stage are required to prevent bolting.
Breeding work has now been started at Khibiny with barley and other cereals, and with various small bush fruits, with the object of producing early forms according to the principle of phasic development.

505. BROKERT, P. 575:633:578.08
(**The question of the scale of breeding work with self-pollinated plants**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 3/11 : 58–61.

It is pointed out that when dealing with ten factors only one plant in a million will be homozygous in the F_2 progeny and with twenty factors only one in a thousand million. However, if we consider the number of plants capable of producing the desired combination in its segregates, then one such plant occurs in every seventeen in the presence of ten desirable factors and one in three hundred with twenty factors. Given a suitable means of distinguishing heterozygotes from homozygotes all these plants could be used for breeding for the desired combination. Study of a great number of heterozygotes has shewn that very few, if any, are completely indistinguishable from the homozygote. In many cases it is possible to tell by examination which are the heterozygotes containing the desired factors and a careful comparative study of F_1 heterozygotes and the homozygous forms should make it possible to extend the number of characters to which this method can be applied.
The method of deferring selection altogether to a late generation produced by selfing the unselected mixed populations is of advantage mainly only when the desired homozygotes are recessive. The proposed method of selecting the most desirable of the heterozygotes for further breeding considerably increases the ultimate proportion of the required homozygotes. It will be an advantage to grow the early generations under conditions which favour the manifestation of dominance, so that the heterozygotes resemble the homozygotes. In the later stages, however, it will be of advantage to carry out selection under conditions under which the desired combination is recessive, in order that homozygous lines may be selected. Certain characters are capable of treatment in this way, behaving as dominants in one set of conditions and recessives in another; frost resistance is given as an example.

506. Žogolev. 575:633:581.08
(More rapid analysis of grains).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : p. 83.
An apparatus is described whereby 500 seeds can be counted rapidly and without possibility of error; it consists of a board with 500 small apertures, such that when all contain one seed the bottom can be removed and the seeds fall into a vessel below.

507. 575:633:581.192
Sengbusch, R. von 633.367:581.192.6:575.1
Chemie und Pflanzenzüchtung. **(Chemistry and plant breeding).**
Zbl. Zuckerindustr. 1936 : **44** : 264–66.
In making selections for any desired character it is essential to have as full a range as possible of initial material, otherwise the possibilities of success will not be exhausted. For example, the sweet lupins were found only in a proportion of 1 in 20,000 plants. Just as the sugar content of the sugar beet was raised by 20 per cent, German plant breeders are now attempting to bring about a similar increase in the oil, protein and fibre content of their plants.
When the content of a product in the initial forms is low, e.g. below 5 per cent as in the case of alkaloids in the lupin, the environmental fluctuations are small relative to the increase or decrease desired, which may be 100 or more per cent; thus single plants can be taken as the basis for selection. When an increase is desired in a plant containing a high proportion of the material concerned, as in oil seeds, containing 50 per cent of oil and over, an increase of not more than 10 per cent or so is possible and fluctuations are relatively much more important; selection can be carried out only by examining the progenies of the different plants. For this purpose rapid determination is necessary. Methods for the rapid determination of alkaloid and oil content have been elaborated, but for nitrogen the Kjeldahl method has still to be used; it has been modified, however, so that large numbers of rapid estimations can be performed. A rapid method of estimating fibre has recently been devised. By the method for alkaloid 15,000 estimations can be made per person per day, for oil 1,000, protein 40 and fibre 100.
By these methods it has been possible to reduce the alkaloid content of lupins to zero, to raise the oil content by 50 per cent and the protein by 15 per cent. In rye the protein content of certain forms from Asia Minor has been raised to 22 per cent and in potatoes and sunflowers the protein content has been increased by 300 per cent. Similar improvement in composition of the fruit has been effected in tomatoes by crossing with wild forms and experiments are being made to reduce the acid content of rhubarb and the mustard oil content of mustard.

508. Zaika, I. E. 575:633–2.951.1
(Chlorpicrine as a help to the breeder).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 4 : p. 47.
Chlorpicrine applied to the soil about ten days before sowing destroys insect pests and at the same time increases the yield, so enabling a higher coefficient of multiplication of breeding material to be achieved. It causes no damage to the plants.

509. Mahoney, C. A. 575:635
Methods which the market gardener might use in breeding vegetables.
Mich. Exp. Sta. E. Lansing, Michigan 132–38.
Vegetable crops are classified into three groups according to their mode of pollination, namely, naturally self-pollinated, often cross-pollinated and naturally cross-pollinated. The object of the market gardener should be the development of uniform strains rather than the production of new varieties.
In the first two classes this can be achieved by continued selfing with selections for the desired type, and the routine to be followed is outlined. In the third class, mass selection is the method recommended for market gardeners.
Gardeners can also help in the work of breeding for resistance to disease and insects, by reporting to their local experiment station cases of single plants apparently free from disease when all surrounding plants have suffered severely.

510. Just, E. E. 575.1:577.9
A single theory for the physiology of development and genetics.
Amer. Nat. 1936 : **70** : 267–312. (Suppl.).
On a basis of the increase in nuclear material which occurs during cleavage of the developing egg, an hypothesis is advanced to the effect that differentiation is due to the removal of potencies from the cytoplasm by the chromosomes, a phenomenon which the author terms genetic restriction. Similarly, at later stages the genes function by removing material and so leaving the factors of heredity, which the author considers to be located in the cytoplasm, free to express themselves.
Other theories of differentiation and development are severely criticised.

511. Tosello, A. and Graner, E. A. 575.114
A relação *1DD : 2Dd : 1dd*. (**The ratio *1DD : 2Dd : 1dd***).
Rev. Agric. S. Paulo 1936 : **11** : 293–94.
In continuation of the previous article ("Plant Breeding Abstracts", Vol. VII, Abst. 98) it is shewn that the theoretical 1 : 2 : 1 ratio will be more nearly approached the greater the number of individuals in the population examined.

512. 575.12:578.08:581.162.3
(**A ring for artificial pollination**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 4/12 : p. 71.
Reference is made to a device for facilitating pollination, constructed by a Danish breeder and illustrated in the journal *Landmanden*, **56** : No. 37, for 11th September, 1935. It consists of a ring to which are attached two small containers for carrying the pollen, the whole being worn on the first finger of the left hand in which the infloresence can be held while pollination is being carried out.

513. Colin, H. 575.12:581.192
Chimisme et hybridation chez les végétaux. (**Chemistry and hybridization in plants**).
Rev. Gén. Sci. Pur. Appl. 1935 : **46** : 699–702.
Though certain chemical differences such as the presence or absence of tannin, alkaloid, etc., etc. seem to exercise no influence whatever on hybridization, the inulin which in the artichoke replaces the starch of the sunflower seems to exert a great influence, since attempts to cross these two plants have almost always failed. Similar cases are met in *Hordeum bulbosum*, which contains a peculiar fructosan, and other instances are mentioned. However in certain other cases plants such as wheat, containing lenosin and *Agropyrum*, containing triticin, can be crossed in spite of their chemical differences.

514. Deržavin, A. 575.127:581.143.26
(**The problem of perennial habit in agricultural plants**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 9–10.
Stimulated by the production of perennial hybrids of *Triticum* and *Agropyrum* (see "Plant Breeding Abstracts", Vol. V, Abst. 78), the author has made crosses between perennial rye and *T. durum*. The F_1 hybrids were perennial but were sterile; they yielded a few seeds from artificial pollination. From amongst the plants obtained the perennial ones were retained. The best F_5 hybrids are equal to the best standard varieties in yield per ear, size of grain and drought resistance. They are late in earing however and mostly brittle in the ear. Perennial rye has also been crossed with common rye, the hybrids in this case being partially fertile. Some of the F_4 perennial hybrids have large tough ears and grain of the cultivated type, and in the first year of growth are not inferior to the best cultivated rye.
Similar crosses have been made between perennial and cultivated sorghums.
The object of all these crosses is to produce forms suitable for cultivation both for grain and hay. Similar crosses have been made between annual and perennial sunflower species in the attempt to combine oil and tuber production.

515. SCHÄFER, W. 575.14:519.2
Über die Zunahme der Isozygotie (Gleicherbigkeit) bei fortgesetzter Bruder-Schwester-Inzucht. [**On the increase in isozygoty (genetical identity) in continued brother-sister inbreeding**].
Z. indukt. Abstamm.-u. VererbLehre 1936 : **72** : 50–79.

The problem of obtaining genetically uniform and pure material is stated to be relatively simple when self-fertilization is possible; when brother-sister mating has to be employed, as in the higher animals, the relation between the number of generations and purity becomes complex. The author introduces the term "isozygotic" meaning homozygous at a given locus and carrying the same allelomorphs. Isozygotic parents will therefore give no segregation when mated.

The value he calculates mathematically is the proportion of isozygotic sibs in the F_n generation of a population in which only brother-sister mating has taken place. This gives the probability of obtaining a non-segregating race from the F_n sibs and has considerably more practical value than the proportion of homozygous individuals.

The increase in isozygoty by brother-sister mating following different types of original matings and for autosomal and sex-linked characters is calculated and given in the form of tables and curves.

516. LAZAREV, N. 575.148:575.12
(**On the method of rejuvenation of varieties according to "marriage for love"**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 4 : 26–27.

The author admits the main premise of Lysenko (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 765 and Abst. 517 below) that most so-called pure lines are heterozygous for certain physiological characters, while doubting whether this would necessarily lead to an impoverishment of the variety—rather the reverse, on the assumption that the heterozygotes will display heterosis and so be more vigorous. Whether the application of mixed pollen has any advantage over artificial pollination within the variety is shewn to be doubtful even from Lysenko's own words. The possibility of subsequent segregation even of the intravarietal hybrids, followed by loss of vigour, must also not be overlooked.

517. RJABOV, N. M. 575.148:575.12
(**Theoretical and practical importance of seed rejuvenation**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No.3 : 48–57.

Lysenko's theory (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 765) which is briefly recapitulated, consists of the following main theses:—

(1) breeders have hitherto concerned themselves with externally obvious characters and ignored the inner physiological characters such as those, for instance, connected with the phasic development of the plant;
(2) thus the existing varieties of self-pollinating crops, though homozygous for the common characters with which breeders have concerned themselves, are heterozygous for these various physiological characters and in each successive generation continue to segregate;
(3) hence with each generation this so-called "pure" line segregates out into a population of homozygous forms. These forms, being homozygous, are biologically impoverished as regards adaptation and the variety is in consequence degenerated.
(4) by artificially pollinating with a mixture of pollen collected from the entire population, each egg cell is in a position to select the pollen most nearly adapted to it in the given conditions. As a result of this "marriage for love" the heterozygosity is again restored and hence the adaptability of the zygote to variations in conditions is restored, since the new zygote combines the adaptive potentialities of both gametes.

Figures are given to shew that the relative fall in heterozygosity with successive generations becomes greater with the number of segregating characters and increases in more than geometrical progression from generation to generation. The arrival of a state when the entire population consists of homozygous lines is prevented by the tendency for the more vigorous

and adaptable heterozygous lines to be selected in favour of the homozygotes. The selective action of the environment can, however, be different in different years and if in a particular, abnormal, year its effect is to select those elements of the mixed population that are least adapted to the conditions of a normal year, this may have a catastrophic effect on the resulting population, which will immediately shew the effects of degeneration. The remarkable changes that sometimes come about in a variety when transferred from one region to another are explicable on such a basis. That most if not all of the existing varieties are impure for many physiological characters, especially those connected with their phasic development, for which no selection has been performed in their production, can be open to no doubt whatsoever. Thus if in consideration of the phasic development of a given variety, and of the conditions of the region in which it is required to be grown, a particular alteration of its phasic characters is desirable, it is often possible to effect this by selection under suitable conditions.

However, whether there exists a competition between the differently "adapted" pollen grains and whether this, if it exists, need necessarily lead to a more "adapted" or desirable individual, as claimed by Lysenko, remains open to much doubt. Cultivated plants in general, for example, are notoriously less vigorous than their wild relatives, but none the less desirable. It is further pointed out that in order to restore the original state of heterozygosity for the physiological characters not one crossing but many would be necessary. It is for this reason, combined with the difficulty of knowing which would be the best combinations of parents to cross, that the method of mixed pollen is thought to be the best, quite apart from any possible selection on the part of the pollen and egg cells. When a method of deliberately choosing the best combinations is available it will unquestionably be preferable. This, combined with the action of natural selection in preserving the more vigorous heterozygotes, will largely restore heterozygosity as regards the characters with a selection value; the characters with an industrial but no selection value will not be affected by either process and are not, therefore, concerned. Thus one of the main objections of Kozlov and Matveev (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 771) is removed and others are disposed of similarly.

518. Rodičev, S. A. 575.148:575.12
(On pure lines).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 4 : 23–25.

The author defends the view that any so-called pure line in reality consists of a large number of segregates, differing in their genetical constitution as regards many physiological characters, some being above the mean, others below, the average for the line as a whole remaining much the same from generation to generation. The proportion of the different components can, however, change if environmental conditions change in such a way as to favour one type more than the other. If it is a less desirable type that is favoured over a number of seasons then the variety can truly be said to have "degenerated". Most old varieties should, therefore, be susceptible of improvement both by further selection and by Lysenko's method of crossing within the variety.

519. Eremeev, I. M. 575.148:575.42
(Problems of creating super-élites).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 15–19.

The methods used for keeping the lines and the creation of élite stocks pure are described. Speltoid and other mutants have been observed in wheat varieties and it is clear that the process is equally necessary in self-pollinated and in cross-pollinated plants.

520. Haase-Bessell, G. 575.173
Chromatin, Chromosomen, Gene. **(Chromatin, chromosomes, genes).**
Planta 1936 : **25** : 240–57.

An argument is presented in favour of the theory that the chromosomes are to be regarded as colloidal systems, the genes as highly specialized catalysts and the matrix as a co-ordinating medium for the reaction products and ensuring the correct biological functioning in the whole organism.

521. DELLINGSHAUSEN, M. VON 575.182
Entwicklungsgeschichtlich-genetische Untersuchungen an *Epilobium.* VIII. Über vergleichende Viskositätsmessungen an zwei genetisch verschiedenen Plasmen. (**Developmental-genetic investigations with *Epilobium.* VIII. On comparative viscosity measurements made upon two genetically different plasmas**).
Planta 1936 : **25** : 282–301.

A further confirmation of the existence of plasma differences in *Epilobium hirsutum* and *E. luteum,* in which various differences relating to the viscosity of the plasma were found (Cf. also "Plant Breeding Abstracts", Vol V, Abst. 600 and Vol. VI, Abst. 772).

522. NAWASCHIN, M. S. 575.24
Untersuchungen über die Natur der Mutationen. (**Investigations on the nature of mutations**).
Probleme der Theoretischen Biologie, Arbeiten aus dem Timirjaseff-Institut für Biologie Moskau. Herausgegeben zum 15. Todestag von K.A. Timirjaseff, Moscow & Leningrad 1935 : 120–37.

A brief account of the author's work on the process of mutation in aging seeds (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1151) and its acceleration by increased temperature and humidity, with special emphasis on the theoretical aspect. It is stressed throughout that mutation is a natural attribute of life, closely connected with inheritance, the two phenomena representing different stages in development.
The importance of heat, humidity and aging with reference to breeding and seed-growing respectively is discussed and its significance for ecology is also mentioned.

523. MULLER, H. J. 575.24:575.17
(**The present status of the mutation theory**).
Priroda (Nature) 1936 : No. 6 : 40–49.

Recent experiments on salivary gland chromosomes have indicated that the gene is just below the limits of microscopic resolution and is filiform, as a protein molecule is supposed to be. The constancy of mutations immediately upon their production shews the gene to consist of a single molecule. The fact that two genes obviously lying side by side often mutate independently, shews mutations to be microchemical phenomena, changes resulting from certain molecular or atomic movements to which the gene is particularly sensitive. In support of this it has also been found that within the range of temperatures normal for an organism, a rise of temperature brings about the expected increase in the mutation rate; temperatures above the normal bring about a still further rise in the mutation rate. However, as has been pointed out by Timoféeff-Ressovsky, the increase even at normal temperatures is several times greater than would be expected from Van t'Hoff's law; it is pointed out in explanation of this that a rise in temperature also affects other processes in the cell, which in turn may have an influence on mutation. The effect of physical agencies appears to be confined to the particular cells treated, and for this and other reasons is regarded as a direct action upon the molecule. Various factors, such as the condition of the cell, age, growing or dormant, and temperature, etc., influence the rate of induction of mutations by X-rays, but even this is not regarded as a proof of their indirect action.
Different genes have very different rates of mutations. Furthermore, though most genes tend to mutate in particular directions, some genes give mutations of a variety of different types which phenotypically would never be recognized as having any connexion; other cases are known in which a gene may suffer an internal re-arrangement without any phenotypic effect.
Owing to the complexity of the gene and of the organism, the possibilities of a change proving more efficient rather than less are very slight, and this explains the relative rarity of superior mutants, which, however, do at times occur both in natural and in X-rayed material. The natural tendency of the gene is to change in the direction of greater simplicity rather than

greater complexity and this, therefore, accounts for the recessive character of most of the mutations.
Sharp, easily detectable mutations are now known to be exceptional, the vast majority of mutations being of the minute type, mostly indetectable in single doses. These many minute mutations have provided the basis for natural selection and the clue to the mechanism of evolution as envisaged by Darwin.
Reference is made to unpublished data which indicate that the rate of chromosome mutations is not proportional to the dose of X-rays as is the rate of true gene mutations.

524. 575.24:581.01
576.312.36:576.16
633.14:575.243
Nawaschin, M. and Gerassimowa, H.
Natur und Ursachen der Mutationen. I. Das Verhalten und die Zytologie der Pflanzen, die aus infolge Alterns mutierten Keimen stammen. (**Nature and causes of mutations. I. The behaviour and cytology of plants arising as a result of aging of mutant embryos**).
Cytologia, Tokyo 1936 : **7** : 324–62.
Already reviewed from the original Russian (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1151).

525. Russo, A. G. 575.243:537.5
Mutaciones provocadas. Acción de los rayos–X y del radio sobre el sistema genético de los organismos. (**Induced mutations. The action of X-rays and radium on the genetical system of organisms**).
Agronomia, La Molina 1936 : **1** : 9–13.
The most common types of alteration, chromosomal and genic, resulting from artificial mutation, induced by X-rays and radium are described briefly. Experiments with X-rays on cotton are in progress at the research station of La Molina, Peru.

526. Demerec, M. 575.243:537.531
Heredity and radiation.
Radiology 1936 : **27** : 217–20.
On the basis of work on *Drosophila* the following conclusions about the genetical effects of X-ray irradiation are indicated: over 80 per cent of the detectable changes in genes result in the elimination of the gene, apparently through loss of the ability to reproduce. Chromosomal rearrangements and gene changes may not be independent. The quality of the radiation, within the range tested, has no effect on the frequency of gene changes. There is a simple relation between the number of electron hits and the frequency of gene changes. Gene changes can be produced in somatic cells as well as in germ cells.

527. Kraevoi, S. J. 575.243:537.531:633.16
(**Is it possible to produce useful mutations experimentally?**)
Priroda (Nature) 1936 : No. 5 : 62–65.
Reference is made to artificial mutations obtained by various authors of such a kind that they can be regarded as superior to the original. Unpublished data by Pis'menko are also referred to. This investigator subjected the barley *Medicum* 046 to X-ray treatment at the time of meiosis and obtained mutants of various kinds; these included plants with tubular leaves, reduced or no awns, late maturity, dense ear, and finally awns on the empty glumes. This last type was also distinguished by very large ears with an average of 30 spikelets as compared with the normal 25. It is more vigorous in growth too and is regarded as a promising mutant. The awnless mutant is also regarded as of practical value, so that in these experiments at least two of the mutants obtained are seen to be useful.

528. Ducomet, V. 575.257:581.162
La greffe envisagée au point de vue génétique. (**Grafting regarded from the genetic standpoint**).
Sélectionneur 1936 : **5** : 95–101.
In addition to a number of general considerations on the problem of interaction between scion and stock and on the nature of chimaeras originating at the point of union, the author expresses doubt as to the possibility of hybridization by grafting, his main objection being based on the physical hindrances which must prevent the actual chromosomes from one cell mixing with another. Nevertheless in view of the fact that the protoplasm which supplies the chromosomes with nourishment also acts as a medium of communication from cell to cell, the possibility of hybridization by grafting should not be rejected *a priori*.

529. Meyer, A. W. 575.31:575.4
Haeckel, Lamarck and "intellectual inertia".
Amer. Nat. 1936 : **70** : 494–97.
A brief discussion of the article reviewed in "Plant Breeding Abstracts", Vol. VI, Abst. 448; Haeckel is defended from the charge of intellectual inertia and it is also suggested that he did not unconditionally accept Lamarck's views.

ORIGIN OF SPECIES, ETC. 576.16

530. Polianski, V. I. 576.16:575.12
(**The role of genetics in plant systematics**).
Sovetskaja Botanika (Soviet Botany) 1936 : No. 2 : 3–20.
In examining the conclusions of various investigators, principally Heribert-Nilsson, that the species are mere artificial conglomerations of morphologically similar forms without necessarily having any phylogenetic relationship, the author points out that these conclusions are based on crossing experiments with one particular, and in many ways peculiar, genus, *Salix*, and should not, therefore, be generalized. Present-day systematics are based not merely on external resemblance but also on the geographical, ecological, biological and cytological principles as well as on direct genetic experimentation, and as time goes on will arrive nearer and nearer to a true phylogenetic arrangement of the plant kingdom.

531. Turesson, G. 576.16:581.5
Rassenökologie und Pflanzengeographie. Einige kritische Bemerkungen.
(**Race ecology and plant geography. Some critical remarks**).
Bot. Notiser 1936 : 420–37.
The continuous variation from the northern to the southern types observed by Langlet (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 508) in the pine is thought to be explicable by its habit of out-pollination and the great distances to which the pollen will travel. A re-examination of the data, however, leads the present author to conclude that the variation is not continuous, but of the type normally obtained when a number of genetically distinct ecotypes adapted to different areas are present. The same conclusion is reached with respect to certain other authors' data, which are subjected to piercing criticism.

CYTOLOGY 576.3

532. Berrill, N. J. and Huskins, C. L. 576.312:001.4
The "resting" nucleus.
Amer. Nat. 1936 : **70** : 257–61.
To replace the term "resting nucleus", "energic nucleus" is suggested, to convey the notion that although stationary, the nucleus in this condition is yet physiologically active.

533. KAUFMANN, B. P. 576.312.32
Chromosome structure in relation to the chromosome cycle.
Bot. Rev. 1936 : **2** : 529–53.
A survey of the recent work on spiral structure in chromosomes in relation to the chromonema-matrix conception of chromosome structure.
The author holds the view that a somatic metaphase chromosome contains four chromonemata and a bivalent at meiosis eight. He considers that more evidence is needed before general theories of chromosome mechanics can be laid down.

534. ELLENHORN, JA. E. 576.312.34:575.17
(The cytology of genetically important nuclear structures).
Sovetskaja Botanika (Soviet Botany) 1935 : No. 4 : 62–71.
After a brief discussion of recent facts and views concerning chromosome morphology, the author reports observations of his own on barley roots fixed after chilling. The entire nuclear material was pressed, in a swollen form, towards one pole of the nucleus and it was possible to detect a number of extremely fine, twisted, colourless threads which are evidently the chromosomal skeletons, the bases on which the chromatin is deposited to form the chromosomes. Resting nuclei may contain only these skeletons or also varying amounts of chromatin. The skeleton threads, two per chromosome, have also been observed *in vivo*. The form of the threads, moreover, corresponds to the morphology of the different chromosomes. The author regards these, and not the chromomeres or other chromatin bodies, as the genetic material of the chromosome. The points along the thread at which the chromomeres form may have some special genetic activity. Further investigations on this point are in progress.

535. SUGIURA, T. 576.312.35
A list of chromosome numbers in angiospermous plants. II.
Proc. Imp. Acad. Japan 1936 : **12** : 144–46.
The chromosome numbers (mainly haploid) of 160 plants determined by the author in representatives of a large number of different genera are reported.

536. JEFFERY, E. C. 576.312.38
On the structure of chromosomes.
Science 1936 : **84** : 372–73.
Using new methods of fixation (not here described) the author has arrived at certain conclusions with respect to chromosome structure.
In the prophase the chromosome consists of two chromatids or filaments coiled in opposite directions around the outside of a matrix, the crossings of these spirals presenting an illusion of chromomeres. The spirals straighten out as metaphase approaches until in the later stages of the metaphase the chromatids have completely lost their curliness and lie parallel side by side. At this stage or earlier the chromatids clearly separate from each other and each in turn becomes double, the newly-formed filaments being coiled round each other in reverse directions. During anaphase and telophase the course of events is obscured by contractions, but emerging from the telophase the spirals become broader and shorter and thus pass into the resting stage.
At meiosis the course of events is closely similar, the chief difference being the halved number of chromosomes and their greater size. In *Trillium* and *Tradescantia*, however, the paired filaments of the individual chromosomes are spiral but run parallel to each other; the same relation exists in the gametophytic soma of *Trillium*.

537. SAX, H. J. and SAX, K. 576.354.4:576.312.34
Chromosome structure and behavior in mitosis and meiosis.
J. Arnold Arbor. 1935 : **16** : 423–39.
The mitotic and meiotic cycles are described in various plants, including *Vicia Faba*, *Zea*, *Allium Cepa* and *Secale cereale*, from which it is concluded that meiosis differs from mitosis in being more leisurely. The observations that when the anaphase chromosomes pass into the resting stage they are two or four parted and that the meiotic prophase chromosomes are

longer than those of the mitotic spireme are adduced in support of this view. The retardation in meiosis is particularly marked in prophase, thus enabling the coils to straighten out, which never entirely happens at mitosis, this permitting homologous chromosomes to become associated before the chromatids split and again begin to coil.

538. MATSUDA, H. 576.356:581.036
(Experimental studies on the influence of the temperature upon the formation of giant pollen grains).
Proc. Crop Sci. Soc. Japan 1936 : **8** : 133–39.

Experiments with the New Blue variety of *Petunia* shewed that under high temperature there was a tendency to scattering of the chromosomes and reduction in the spindle fibres present and other abnormalities of division. The effects of various temperatures acting for varying periods were observed. The significance of high temperature as compared with change of temperature was studied and rapid rise in temperature was found to play a particularly important role in producing the abnormalities described.

539. SAX, K. 576.356.5:578.08
The experimental production of polyploidy.
J. Arnold Arbor. 1936 : **17** : 153–59.

It is estimated that about half the angiosperm species are polyploids. This is shewn to be natural since allopolyploid interspecific or intergeneric hybrids usually merit specific and not infrequently generic rank. Cases are now known of the origin of about fifty allopolyploids, of which eight have originated in nature. Many of the cultivated plants are apparently of similar origin.

Among the agencies mentioned as producing polyploidy are low and high temperature. Plants of *Rhoeo discolor* kept by the author in a cold pit at a temperature of 5° C. for several days and then returned to the greenhouse produced many diploid pollen grains. Better results still were obtained by keeping for two or three days at 10° C. and then at 36° C. for one day and returning to the greenhouse. The first effect of the treatment is asynapsis, leading to the production of dyads and pollen with the double chromosome number. These are much more fertile than the normal pollen from diploid plants, which owing to ring formation are 80 per cent sterile.

Some tetraploid microspores were also formed, by the entire suppression of nuclear division following upon division of the chromosomes.

It is pointed out that the polyploid economic plants have largely originated in tropical regions of high altitude, in semi-arid regions and in zones along the sea coast, all areas where rapid and extreme changes of temperature occur and where the origin of polyploidy would hence be expected. The greater vigour of the polyploids results in an increase in range of distribution and it is noticeable in some genera that the periphery of this area of distribution is characterized by a greater proportion of polyploids.

540. FISCHER, A. and SCHWANITZ, F. 576.356.5:581.5:575
Die Bedeutung der Polyploidie für die ökologische Anpassung und die Pflanzenzüchtung. **(The significance of polyploidy for ecological adaptation and plant breeding).**
Züchter 1936 : **8** : 225–31.

A review of the literature on the subject of polyploidy in relation to geographical distribution shews that there may be a close connexion between the chromosome number of a species belonging to a polyploid series and its adaptability, or suitability to different ecological conditions.

It has also been found that an increase in chromosome number may be related to a difference in osmotic pressure which may be reflected in the relative hardiness of the plants and, on the whole, autopolyploidy appears to reduce the resistance to extreme external conditions.

Heteroploidy may cause the appearance of entirely new morphological characters, as in *Raphanobrassica*, and such plants may be suitable for cultivation under a wider range of ecological conditions.

EXPERIMENTAL TECHNIQUE 578.08

541. Schröder, E. 578.081:581.46
Ein neues Verfahren zur Gewinnung "typischer Ähren" für Ährenanalysen und dessen Anwendungsmöglichkeiten in Praxis und Theorie. (**A new method of obtaining "typical ears" for ear analyses and its possibilities of application in practice and theory**).
Landw. Jb. 1936 : **83** : 229–42.

The principles are discussed which should be followed in choosing representative ears from a variety or line. Rachis length and total spikelet number are considered reliable and convenient characters; also the number of rudimentary spikelets at the base; the individuals are arranged according to these three characters, whereupon it is possible to select the required number of ears (4 to 10) from the most typical group. By the character of the groups it is also often possible to detect genetical differences between two lines.

BOTANY 58

542. Boonstra, A. E. H. R. 581.13:631.557:581.48
Der Einfluss der verschiedenen assimilierenden Teile auf den Samenertrag von Weizen. (**The influence of the various parts concerned with assimilation on the yield of the wheat grain**).
Z. Zücht. 1936 : A **21** : 115–47.

Continuing his researches on physiology in relation to plant breeding (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 612) the author has turned his attention to the problem of yield. The experiments consisted in the removal or shading (from the time of flowering) of the green parts of the plant and estimating the effect of their loss on the grain. The results shewed that the ear had the greatest effect on the grain and that of the four leaves, the effect diminished from the uppermost downwards. The peduncle also had a considerable effect.

543. Dobrokhotov, V. N. 581.142:578.081
(**The rapid determination of the germinating capacity of seeds**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 56–60.

A new method for the rapid determination of the germinating capacity of a cereal seed is described, consisting in soaking it in a solution of dinitrobenzol; on cutting across the embryo the roots within are coloured purple on account of precipitation if they are alive but remain uncoloured if the embryo is dead. The results agreed fairly closely with the experimental determination of germination capacity in the thermostat.

SEROLOGY 615.37

544. 615.37:633.51–2–1.521.6
Fedotova, T. 633.51–2.484–1.521.6:615.37
(**Serological method of determination of varietal resistance of cotton plant to the diseases**).
Plant Protection, Leningrad 1935 : No. 5 : 11–32.

Serological experiments were performed with various cotton varieties belonging to three different species *Gossypium barbadense*, *G. hirsutum* and *G. herbaceum* and three different parasites, *Fusarium bucharicum*, *Verticillium dahliae* and *Bacterium malvaccarum*. In the case of species susceptible to a given parasite there was a definite precipitin reaction between the serum prepared from the parasite in question and the globulin fraction of the proteins of the species studied. The intensity of this reaction was moreover proportional to the susceptibility of the variety, immune varieties giving no reaction. Other plants such as flax, susceptible to *V. dahliae*, also gave a positive pricipitin test, species known to be immune giving a negative test.

These reactions indicate that the proteins of a susceptible variety and its parasite are related and the method presents an extremely promising new possibility in selecting varieties for disease resistance.

545. ALEKSANDROV, A. B. 63.00.15(47)
(The Institute of Plant Industry and its current problems in increasing yield).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 11–14.
A very brief outline is given of the work of the institute in 1936 and of the problems for the future in the fields of plant collection, development of more productive and disease-resistant strains, and on distant hybridization. The gulf between theory and practice in plant breeding, to which reference has previously been made, is gradually being bridged.

546. 63.00.15(47)
KONSTANTINOV, P. N. 575:633(47)
(The programme of work for the Kinel' Breeding Station).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 32–39.
The ecological conditions of the area served by the station vary very sharply from place to place and the author urges the necessity of breeding being carried out expressly for each of the regions concerned. Particular methods of crop rotation, agronomy, etc., must also be taken into consideration in any successful breeding programme; varieties suitable for a number of different places and conditions are mentioned.

547. 63.00.15(73)
575:633:058(73)
Directory of activities of the Bureau of Plant Industry.
Misc. Publ. U.S. Bur. Pl. Ind. 1936 : No. 238 : Pp. 130.
A brief but comprehensive and authoritative account of the work of the United States Department of Agriculture, Bureau of Plant Industry. After defining in general terms the scope of the activities of the Bureau as a whole and of the different sections, the projects in the different states are described. There are also entries for Puerto Rico and the Canal Zone. A useful feature for visitors is the provision of instructions for reaching the different experiment stations.
There are also provided useful indexes, a map of the U.S.A. shewing the location and character of the field activity and a chart illustrating the organization of the Bureau.

548. 63.0015(92)
*STOKHUYZEN. 633:575.42
Bij het 25-jarig jubileum van het Besoekisch Proefstation. **(On the 25th anniversary of the Besoeki Experimental Station).**
Bergcultures 1935 : **9** : p. 1317.
An outline of the origin, aims and work of the Besoeki Experiment Station.

FIELD TESTS 631.42

549. WISHART, J. 631.42:519.241
The evolution of the field experiment.
Paper read at Plant Breeding Conference, University of Nanking, China. November 1934 : Pp. 12.
A concise account of the application of the principles of replication and randomization to field experiments, leading to the randomized block and Latin square methods.

550. CHENFONG, K. and LEE, S. 631.421:633.18
(A study on the number of replications in pot experiments).
J. Agric. Res., Nat. Cent. Univ., Nanking 1935 : **2** : 23–28.
Uniform trials on wheat and rice were made in pots (height 25 cm., diameter 35 cm.) containing farm sand clay for the purpose of studying the most efficient number of replications from the

* An extended summary of this paper is on file at the Bureau.

standpoint of the percentage probable error of the mean (P.E.M. per cent) in each replicate. Seventy-five and forty-eight observations were obtained respectively. It was found that, in both cases, the P.E.M. per cent decreases very rapidly when the number of replications increases from 1 to 4. The change is small afterwards, indicating that 4 replications are enough in the cases under consideration. P. C. T.

551. Loesell, C. M. 631.421:635.652

Size of plat and number of replications necessary for varietal trials with white pea beans.

J. Amer. Soc. Agron. 1936 : **28** : 534–47.

A uniformity trial was carried out with white pea beans (*Phaseolus vulgaris L.*), in which 1890 plots each ten feet long and one row (28 inches) wide were separately harvested. Allowing for elimination of soil heterogeneity by means of blocks of five plots, standard errors and land efficiency factors were worked out for various combinations of unit plots, (*a*) using all rows and (*b*) discarding outside rows. It is concluded that better results are obtained by harvesting all rows than by allowing for discards, and that while ten replications of a plot 10 feet long and one row wide reduces the standard error of the mean to 4 per cent and is most efficient in the use of the land, the same standard error is obtained with less practical difficulty by having four replications of plots 30 feet long and one row wide without much loss in efficiency, and this size of plot is accordingly recommended. Other sizes were all less efficient. J. W.

PLANT DISEASES 632

552. 632.42:575.247:576.16
632.42:577.8
632.42:633.15

Eide, C. J. 632.42:633.11

The pathogenicity and genetics of *Gibberella saubinetii* (Mont.) Sacc.

Tech. Bull. Minn. Agric. Exp. Sta. 1935 : No. 106 : Pp. 67.

Out of 325 isolates of *Gibberella saubinetii* ascospores all but 31 were of the same cultural type. The occurrence of variants in culture was, however, not uncommon; it was more frequent on Coons' agar than on potato dextrose agar. When first isolated the single ascospore cultures with one exception did not form perithecia, but ultimately, given favourable conditions, most of them did so; the cultural variants apparently lost the ability to do so, with the exception of three variants, whose distinguishing character was actually the ability to produce perithecia and mature ascospores readily in culture. These perithecial variants retained their cultural characteristics and their ability to produce perithecia when propagated by single ascospores, single conidia, or germ tubes, shewing that they are homothallic.

The process of formation of ascospores is similar to that occurring in most ascomycetes.

The pathogenicity of different cultures on seedlings of maize and wheat was compared. The method involved inoculation by immersing the seed in an aqueous suspension of conidia and hyphae, growing the seedlings in numbered batches, with replications. Data on infection were secured by observing the degree of injury of each plant and were analysed by the analysis of variance. By this method it was shewn that significant differences existed between ascospore isolates from the field, but that the differences were in the main small. Much greater differences were distinguished between certain of the cultural variants and between them and their parental forms. Three varieties of wheat and three of maize were used in most of these experiments and they were found to differ in susceptibility. Cases are also mentioned in which the interaction of varieties x lines was significant, indicating that the relative pathogenicity of different lines of the fungus differed on different varieties.

Discussing the nature of the variants, the author points out that the constancy of the perithecial variants following sexual reproduction indicates that, in these cases at least, a permanent change in the genotype has occurred.

553. 632.42:577.8
SWINGLE, R. U. 634.972.8–2.42
A preliminary note on sexuality in *Ceratostomella ulmi*.
Phytopathology 1936 : **26** : 925–27. (Abst.)

Heterothallism in the Dutch elm disease fungus, *Ceratostomella ulmi* (imperfect stage, *Graphium ulmi*) was confirmed, perithecia being developed only from paired monoconidial isolates. Monoascospore isolates from these perithecia have repeatedly produced the *Graphium* stage in culture and on an American elm. Paired monoascospore isolates would also produce perithecia.

The distribution of the plus and minus races in different parts of the U.S.A. is being studied; so far, both plus and minus races have been found among the isolates from New Jersey, New York, Ohio and Virginia; only minus races have been found in Indiana and Connecticut, but only a few isolates have been obtained from these states. Both races have been found on the same trees and in other cases in close proximity.

Different isolates vary in their ability to produce perithecia.

554. GUILLIERMOND, M. A. 632.42:577.81:576.16
Nouvelles observations sur la sexualité des levures et quelques considérations sur la phylogénie de ces champignons. (**New observations on the sexuality of yeasts and certain considerations on the phylogeny of these fungi**).
Rev. Gén. Bot. 1936 : **48** : 403–26, 470–93.

On the basis of a study of difference in sexuality and the phenomena accompanying conjugation in the yeasts, the following three categories were established:—(1) Those in which conjugation precedes ascus formation; (2) those in which conjugation regularly occurs between the ascospores; and (3) those which belong to a group intermediate between (1) and (2) and in which conjugation occurs sometimes between ascospores, but most frequently between the haploid cells derived from the first budding of the ascospores.

The significance of these findings with reference to the systematic relationships of the yeasts is pointed out; and it is suggested that the type of sexuality in group (3) above should form part of the diagnosis of the genus *Saccharomyces*.

555. BECKER, T. 632.451.3:577.8:633.11
Untersuchungen über Sexualität bei *Tilletia tritici* (Bjerk.) Wint. im Rahmen der Immunitätszüchtung. [**Investigations on sexuality in *T. tritici* (Bjerk.) Wint. considered with reference to breeding for immunity**].
Phytopath. Z. 1936 : **9** : 187–228.

Previous work on physiological races and the problem of sexuality in fungi is outlined as a preliminary to a description of the technique evolved for obtaining monosporidial lines of *Tilletia* originating from single spores, a method which made it possible to attack the problem of sex conditions within the progenies from individual spores. Infection tests revealed the existence of bipolarity within such progenies, but combinations of haploid lines of various spores and various collections from different sources suggested that a more complicated condition of affairs probably underlay the phenomena observed which in some ways recalled the relative sexuality theory of Hartmann. The inheritance of virulence and the growth behaviour of *T. tritici* was studied for the first time. From the relatively small amount of data available, results were obtained shewing in one case intermediate and in another case recessive inheritance of the character greater virulence as contrasted with less.

Growth behaviour studied in three generations in sequence proved to be an hereditary phenomenon, but the mode of inheritance was not elucidated.

556. Ghikalov, S. 632.5:576.16:633.522
(Hemp resistance to *Orobanche ramosa* in relation with the varietal peculiarities, photoperiodicity and races of the parasite).
Plant Protection, Leningrad 1935 : No. 7 : 99–118.
Marked differences between varieties were observed in respect of susceptibility to *Orobanche*, both in pot and field experiments, the Italian varieties being quite immune to the Central Russian race of the parasite, except strains that had been reproduced in Russia for a number of generations, which then shewed a certain susceptibility. This is thought to be ascribable to the loss of purity of the strains by cross-pollination or admixture from the local varieties. On the other hand in Italy the Italian varieties are susceptible. To test whether this had any connexion with the light, experiments were made with various types of illumination. The intensity proved without influence on the degree of attack. A 10-hour day reduced the infection in all forms, but the Italian forms remained immune whilst the others were attacked in various degrees.
Tests with *Orobanche* of different origins shewed that whereas the local strain attacks the local hemps, but leaves the Italian one unaffected, strains of *Orobanche* from Italy attacked all hemps; they evidently represent a different race of the parasite, more virulent than the Central Russian race. There are indications that virulent races also exist in other parts of the U.S.S.R.

557. Wålstedt, I. 632.6:576.16
Verschiedene Rassen bei *Heterodera Schachtii* Schmidt. **(Different races of *H. Schachtii* Schmidt).**
Züchter 1936 : 8 : 201–08.
Evidence from a comparison of the behaviour, when in the same soil, of the nematodes of oats and of beet from their morphological characteristics and their behaviour as regards the infestation of certain weeds, and of cereals and beet, is all advanced to shew that such wide differences exist between the two types of nematode that they may be regarded as two separate species. A bibliography is appended.

558. Kostoff, D. 632.8:575.17:576.16
Virus and genic reactions in morphogenetic, physiogenetic and phylogenetic aspects.
Phytopath. Z. 1936 : 9 : 387–405.
The author presents an attempt to integrate the findings in the two branches of science concerned with the study of the gene and of viruses. The principal points of similarity and dissimilarity in the mode of action and the effects produced by these two agencies of change are set forth with copious references to relevant literature. In conclusion, attention is drawn to the function of viruses in the production of diversity due to the formation of abnormal germ cells which may have a phylogenetic value. Virus diseases may also be accompanied by an increased genic mutation rate, which may also have important consequences in phylogeny.

559. 632.8:576.16:575
Holmes, F. O. 633.71–2.8
Comparison of derivatives from distinctive strains of tobacco-mosaic virus.
Phytopathology 1936 : **26** : 896–904.
The "masked" strain of tobacco-mosaic virus, so called because it produces only masked symptoms in *Nicotiana Tabacum L.*, differs from the "distorting" strain, from which it is derived, by such characteristics as failure to induce mottling and distortion in infected plants of *N. Tabacum*. It also differs by a tendency to invade young leaves of *N. Tabacum* less extensively and to remain localized in the inoculated leaf in *N. rustica*.
This difference in invasive capacity was also a feature of the different yellow mosaic strains derived from the "masked" and "distorting" strains respectively (Cf. "Plant Breeding Abstracts", Vol. VI, Absts. 1187 and 1188). Thus lack of invasiveness and yellowing represent independent characters and may be considered each as unit differences possibly similar to the differences between single allelomorphic genes.

560. Kotov, M., Ryss, R. and Karnaukh, E. 632.951.1
(*Halocnemum strobilaceum, Halostachys caspica* and *Kalidium caspicum* as possible raw materials for the preparation of contact insecticides).
Priroda (Nature) 1936 : No. 7 : 127–30.
The extreme value of the insecticide anabasin sulphate obtained from the species *Anabasis aphylla* led to the examination of a number of other plants of the same family. Many of these, which are described, proved to have equally high insecticidal properties.

ECONOMIC PLANTS 633

561. Nakajima, G. 633:576.312.35
Chromosome numbers in some crops and wild angiosperms.
Jap. J. Genet. 1936 : **12** : 211–18.
The reduced and somatic numbers of chromosomes as recorded from pollen mother cells or root tips are set out, with remarks on any peculiar features and comparative data from previous workers and illustrated by diagrammatic figures.

562. Deržavin, A. 633:581.143.26:575
(Let us urge Tzitzin and Veruschkine to compete).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : p. 3.
Breeders are urged to produce perennial forms in a great number of different crops, such that their grain yield in the first year will be equal to the best winter varieties, and in the second and third years exceed them by about 30 per cent, while producing at least two yields of hay in the year.

563. Burpee, D. 633:608.3(73)
More about the double nasturtium patent.
J. Hered. 1936 : **27** : p. 271.
A further contribution to the discussion of the validity of a basic plant patent.

564. Poletika, W. P. von 633–1.524.2(47)
Die russische Agrar-expedition nach Abessinien. **(The Russian agricultural expedition to Abyssinia).**
Naturwissenschaften 1936 : **24** : 230–34.
An account of the exploration of Abyssinia for cereals, carried out in 1927, by the Russian Institute of Plant Industry as part of its work of establishing a world collection of useful agricultural plants. The geographical and agricultural features of Abyssinia are described, as well as the actual expedition and its results. Abyssinia possesses a large proportion of the botanical varieties of wheat and barley in existence and Vavilov's expedition brought back a wealth of varieties of barleys, peas, etc., which, during recent years, has been distributed in northern, southern and other regions of the U.S.S.R. for cultivation and breeding. From time to time interesting observations on the photoperiod and reactions of such sowings and their breeding value have been made and the published results have been reviewed in various issues of "Plant Breeding Abstracts".

565. Volkart. 633–2–1.521.6:575
Die Bekämpfung der Pflanzenkrankheiten durch die Züchtung immuner und resistenter Sorten. **(Combating plant diseases by breeding immune and resistant varieties).**
Landw. Jb. Schweiz. 1936 : **50** : 745–58.
A survey for Swiss readers of what has been achieved and what remains to be done in this field with special reference to field crops.
Most of the literature cited has already been reviewed in "Plant Breeding Abstracts".

566. Vasiliev, I. M. 633–2.112–1.521.6:575
(The notion of drought resistance in plants and the principles of selection for drought resistance).
Priroda (Nature) 1936 : No. 5 : 93–97.

A capacity to withstand drought is dictated by tolerance of three factors: water loss by the cells, increased cell temperature and increased salt concentration. The selective importance of these three factors varies with the type of plant and with the conditions of growth. Thus the ephemerals, dying down during the drought months, are resistant to water loss, the succulents to high cell temperature; plants of the millet type have very low water requirements all through, those of the lucerne group require large quantities of water but are tolerant of drought because of their deep root system. Other plants shed their leaves or reduce them very much in size, and plants of saline soils have an unusual osmotic activity in the roots, which develop a suction pressure of up to 60 atmospheres.
Within one and the same species, e.g. wheat, almost all these different types of adaptation can be found in different ecotypes. In breeding drought-resistant forms for any area, the best type to aim at depends entirely on the nature of the conditions of this area. The most suitable type can best be determined by experimental examination.

CEREALS 633.1

567. Kattermann, G. 633.1:575(43)
Getreidezüchtung. **(Cereal breeding).**
Naturforscher 1934 : **10** : 393–95.

Breeding work in Germany on rye, wheat and barley is described.
In rye the difficulties introduced by cross-pollination are described and the work of the Kaiser-Wilhelm-Institut, Müncheberg, on interspecific crosses with *Secale montanum* and *S. anatolicum* is mentioned.
The early work on pure-line selection in wheat and the development of hybridization methods are described and also the aims of wheat breeding, such as yield, winter-hardiness, resistance to lodging and to diseases, earliness in certain regions and, of course, quality.
The importance of brewing quality in spring barleys and the work of the Bayerische Landessaatzuchtanstalt on resistance to mildew (*Erysiphe graminis*) are mentioned.

568. 633.1:575(49.6)
Gescher, N. v. 575:633(49.6)
Cereal selection in countries of the Mediterranean basin: Turkey.
Int. Rev. Agric. 1936 : **27** : T329–38.

The diversity of climate encountered in Turkey necessitates decentralization of breeding work. Crop improvement which is carried on by the State has been in progress for ten years and there are eight regional selection stations, at Yerilköy, Adapazari, Nazilli, Adana, Eskisehir, Ankara, Antaya and Maltepe dealing with cereals (wheat, rye, barley, oats and maize) forage plants (lucerne, melilot, vetches and sainfoin), legumes (chick peas, beans and lentils) castor oil, poppies, potatoes, cotton, oil plants, coffee, banana, citrus and tobacco. Three new stations are to begin work on rice, textile plants and tea respectively, in 1936. There are also three principal and six secondary trial fields for testing new varieties.
The great diversity of plants in Turkey (Cf. "Plant Breeding Abstracts", Vol. V, p. 167) provides excellent material for the activities of the plant breeder. New varieties of wheat, barley and oats have been produced by selection from local forms, and hybridization between local forms of wheat and with imported wheat varieties such as Mentana has begun.

569. Flaksberger, K. A. 633.1–2.183–1.521.6:578.081
(New principle of morphologically determining the tendency to shedding).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 7 : 59–60.

Various morphological features of the empty glume are mentioned which favour its firm

attachment and hence freedom from grain shedding, the opposite features being associated with a high tendency to shedding; these morphological features are thought to be more useful than actual measurements of shedding for determining the value of parents and segregates in breeding.

570. Gešele, E. E. 633.1–2.44–1.521.6:578.081
[Estimating the resistance of breeding material (cereals) against fungous parasites].
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 3/11 : 34–36.

When dealing with small populations in which very pronounced differences in susceptibility are present the method of mass infection can be used. By this method it has been possible to select smut-resistant wheats from a cross between Ridit and local Ukrainian varieties. For later stages of breeding, where finer differences between competing lines are studied, individual plant infections are made and the most promising lines are carried on to the stage of variety testing.

Another useful method is to sow the F_2 or F_3 populations under conditions most suitable to infection and retain the families which best survive. The degree of infection when grown under natural conditions is also a useful guide in estimating the susceptibility of a variety; this is the method largely applied in selecting for rust resistance, sowing highly susceptible varieties in the vicinity of the lines to be investigated.

WHEAT 633.11

571. 633.11 Canawa
Garber, R. J. and Bennett, L. S. 633.11:575.42(75.4)
Canawa—a new variety of soft red winter wheat.
Bull. Va Agric. Exp. Sta. 1936 : No. 272 : Pp. 8.

Canawa originates from a single head selected from a rather mixed variety grown on the Agronomy Farm, Morgantown, under the name Canada Hybrid. The new variety has purplish, stiff stems, awnless nodding spikes, white glabrous glumes and semi-hard, red, short grains. In yield it is equal to Fulhio, a high yielding wheat under West Virginian conditions.

572. 633.11 *Ferrugineum* 013
Navolotskii, A. V. and Navolotskaja, N. M. 633.11:575.42(47)
(A new variety of spring wheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 3/11 : 72–73.

The new variety *Ferrugineum* 013 has been produced by individual plant selection from the local variety, Mokhnatukha from the Urals. It has proved superior to the original form in yield by 27 to 72 per cent in different years, in thousand corn weight by 4·7 grm. (29·7 as compared with 25) and in earliness, standing capacity, grain quality and resistance to disease. It has also proved distinctly superior to the standard local variety, *Lutescens* 062.

573. 633.11 Frassineto 405
Michahelles, M. 633.11:575(45)
Il frumento "Frassineto 405". Ancora i dubbi del dott. Titta. (**The wheat "Frassineto 405". Further doubts of Dr Titta).**
G. Agric. Domen. 1934 : **44** : p. 394.

Some doubt has been expressed as to whether the variety Frassineto 405 is really a distinct variety and to confirm its authenticity a table of morphological features is given whereby it is distinguishable from the parent variety Gentile Rosso, over which it has proved superior in a number of features. It was produced from a cross of Gentile Rosso x Noè 46.

574. 633.11 Tulun ZA/32
KISLJAKOV, V. D. 633.11:551.566.3:575(47)
(The spring wheat Tulun ZA/32).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 22–25.
The variety was selected from a sample of Huron obtained from the United States Department of Agriculture. It is highly suited to the extreme climate of Siberia. It is later than Novinka in maturity by about a day but has the advantage of a lower heat requirement; it outyielded Novinka over a period of five years by an average of 24 per cent, the difference reaching 41 per cent in certain districts. Also in unfavourable growth years the new variety gave distinctly higher yields than Novinka and also than Garnet. In quality it is, however, slightly below Novinka and like that variety is prone to fungal attack, lodging and to a certain extent also to shedding. These defects must be removed by further breeding.

575. SAFIN, K. A. 633.11:551.566.3:575
(New varieties of winter wheat for the north).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 7 : 67–69.
Brief descriptions are given of the best of the new varieties of northern wheat bred by the Kazan Experiment Station, with indications of their mode of origin. One of the most promising, *Erythrospermum* 01630, gave yields of 22 centner per ha. in 1934–35 and has proved distinctly more frost-resistant than other varieties. It is also free from shedding and shews satisfactory disease resistance.

576. MEUNISSIER, A. and CRÉPIN, CH. 633.11:575(44)
Les problèmes actuels de l'amélioration de la sélection et des champs d'expérience de blé. (**Present day problems of plant improvement, selection and field trials with wheat**).
Sélectionneur 1936 : 5 : 71–80.
In part I of this paper the course of wheat improvement work in France in the past and present century, and the present requirements for the different regions of France in regard to yield, earliness, resistance to cold, to disease and to shattering, and also baking value, are set out. Part II deals with the well-known and accepted technique of field trials with remarks on the time required for such tests, on the existing organization of the research stations and experimental centres for variety trials in the various regions of France. (Cf. "Plant Breeding Abstracts", Vol. IV, Abst. 650).

577. 633.11:575(47)
633.11 Sarrubra
MAMONTOVA, V. N. 633.11 Sarrosa
(The new varieties Sarrubra and Sarrosa).
Seleksija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 37–41.
The two new hybrids of the Saratov breeding station were produced from a cross between *T. durum* (Beloturka) and *T. vulgare* (Poltavka), the latter serving as pollen parent. Awnless segregates were selected in the F_7 and gave rise to the two varieties in question, of which brief descriptions are given. In yield they have exceeded the parents Beloturka and Poltavka by respectively 25·4 and 32·1 per cent over a period of 11 years and the differences have been especially marked in unfavourable years; the yields in most cases have been equal to those of the standard variety *Lutescens* 062. Sarrubra excels the standard variety *Albidum* 0604 in quality and in resistance to smut is not inferior to the standards; both varieties are superior to the standards in freedom from shedding.

578. MEISTER, G. K. 633.11:575(47)
(The production of new varieties of wheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 4/12 : 31–33.
Reference is made to a number of the improved wheat varieties produced at the Saratov Breeding Station, such as *Lutescens* 062, Sarrubra and others referred to in the publications

of the station (Cf. "Plant Breeding Abstracts", Vol. VII, Abst. 85 and p. 116) and to a number of problems that remain to be solved.
The importance of a combined attack with plant physiology and other neighbouring sciences, and of using distant geographical and interspecific crosses is emphasized, and the new approach to plant breeding according to the theory of phasic development is recommended.

579. Nikolaev, S. F. 633.11:575(47)
(On the way to valuable varieties of spring wheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 7 : 64–67.
Data are given from a number of stations and farms, shewing that the variety *Milturum* 0321 is often superior to other varieties in performance when grown in poor conditions. Under favourable conditions of cultivation, however, it is distinctly inferior to certain other of the new varieties, notably *Caesium* 0111 and *Hordeiforme* 010, in yield as well as in grain quality. A warning is sounded against the adoption of new varieties without due conviction as to their merits and the value of the local "land" races for breeding is emphasized.

580. Pokhil', I. F. and Kovtun, T. D. 633.11:575(47)
(Let us give the country new varieties of winter wheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 1 : 54–55.
Crosses carried out in 1925 and 1926 at the Verkhnjak station between the variety Ukrainka and various other wheats of local origin have yielded two very promising hybrids, Nos. 09 and 010, outyielding Ukrainka by 20 to 30 per cent over a period of five years. They are resistant to brown rust and smuts, hardier than Ukrainka and approach it in baking quality. No. 09 also has exceedingly strong straw.

581. Scharnagel, Th. 633.11:575:664.641.016
Ein Jahr Kleberweizenuntersuchung in Weihenstephan. **(A year of high gluten wheat tests at Weihenstephan).**
Prakt. Bl. Pflanzenb. 1936 : **14** : 157–64.
Tests of numbers of spring and winter wheats are recorded and confirm the heritability of gluten quality.

582. Ducellier, L. and Laumont, P. 633.11:575:664.641.016(65)
L'amélioration du blé tendre en Algérie. **(The improvement of soft wheat in Algeria).**
Inst. Agric. Algérie : Pp. 8.
An account of the development of wheat improvement work in Algeria from the mass selection of early days to the somewhat more clearly defined lines of present-day breeding, in which hybridization and selection for quality from various crosses is practised.

583. Schneidermann, Ja. A. 633.11:575"793"
(Dominance of earliness in the first generation hybrids of soft wheats).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 1 : 24–31.
Hybrids from a number of crosses of soft wheats were grown under such conditions that only those with a short thermo- and photo-stage came to maturity. In crosses of semi-winter with spring forms the spring habit was dominant in the F_1, so that the hybrids had all come into ear at a time when the late parents (with the long first stage) had not even begun ear emergence. In some crosses the hybrids eared almost simultaneously with the early parent, but in others distinctly later, whilst in one combination, transgression for earliness was observed, the hybrid being five days before the spring parent in ear emergence.
Similar differences in the amount of dominance of earliness were observed in crosses of the spring forms with later spring forms (i.e. with not such a long first stage as the semi-winter

varieties referred to above). In some crosses the hybrids were almost as early as the early parent, while in other combinations the hybrid was intermediate between the two parents. In certain combinations again the hybrid was almost as late as the later parent (the one with the longer photo-stage) and in one case there was a transgression for lateness to the extent of six days.

584. FLORELL, V. H. and MARTIN, J. F. 633.11:575.11–181.13
Inheritance of complementary dwarfing factors in wheat.
J. Agric. Res. 1936 : **53** : 151–60.

Dwarf F_1's were obtained in crosses of Turkey-Florence with Jenkin, Federation, Baart and the two Arco selections 8120 and 8118, and in crosses of Hussar-Hohenheimer with Jenkin and Arco selections 8118 and 8120. Though deficiencies in the numbers of dwarf plants often occurred, owing to their greater susceptibility to winter killing, the segregations obtained in F_3 and in one of the F_2's, were in accordance with the hypothesis that Turkey-Florence and Hussar-Hohenheimer carry *iiddEE*, while Jenkin, Federation, Baart and the two Arco selections carry *IIDDee*, where *D* is a dominant factor for dwarfness, *I* a dominant inhibitor of *D*, and *E* a further factor which in the presence of *D* produces dwarfness in spite of *I*, but in the absence of *D* has no effect.

585. WAKAR, B. A. 633.11:575.127
Neue dreifache Weizenbastarde. (**New triple wheat hybrids**).
Züchter 1936 : **8** : 249–55.

The possible origin of *Triticum vulgare* from crosses between various genera and *Aegilops* species is mentioned and the following seven intergeneric hybrids obtained since 1932 at the Omsk Agricultural Institute are enumerated:—

(1) (*Aegilops ovata* x *Triticum persicum fuliginosum*) x *T. monococcum* Hornemanni, the F_2 of which in 1935 yielded one well-formed grain.
(2) (*Triticum polonicum villosum* x *T. dicoccum rufum*) x *T. monococcum*, from which six grains were obtained which all germinated but resulted in completely sterile plants.
(3) (*Aegilops ovata* x *Triticum monococcum* Hornemanni) x *T. vulgare*, which yielded two grains, ultimately resulting in sterile plants.
(4) (*Triticum durum* Schechurdini C–229 x *Aegilops ovata*) x *T. vulgare* Rümker, which gave one grain from which a plant developed resembling *Aegilops triticoides* but sterile.
(5) (*Triticum durum* Schechurdini C–229 x *Aegilops ovata*) x *T. polonicum villosum*, the single grain from which did not germinate.
(6) (*a*) (*Triticum durum* Nosatovski C–174 x *T. monococcum* Hornemanni) x *T. vulgare* Rümker, which gave five grains.
(*b*) (*Triticum durum* Nosatovski C–174 x *T. monococcum* Hornemanni) x *Aegilops ovata*, yielding one grain.
(*c*) (*Triticum durum* Nosatovski C–174 x *T. monococcum* Hornemanni) x spring rye, which resulted in one grain.
(7) (*Triticum vulgare* Baart x Hussar 298 x *T. durum* Stebuti C–196) x spring rye, which yielded four grains, which produced externally typical wheat x rye hybrid plants that were sterile.

A number of the morphological features of these triple hybrid plants are recorded with notes on the resemblances and differences as regards the parent forms. The cytological investigations of the hybrids have still to be made but chromosome unbalance and other irregularities have been found in the plant 66 B, one of the three plants from 6(*a*) above.
The paper concludes with a critical survey of the work referred to in the bibliography, most of the articles in which have already been reviewed in "Plant Breeding Abstracts".

586. Antonoff, S. 633.11:575.127.2:576.353
Beitrag zum zytogenetischen Studium der Artbastarde *Triticum turgidum* x *Triticum durum*, *Triticum durum* x *Triticum monococcum* und *Secale cereale* x *Secale montanum*. (**A contribution to the cytological study of the species hybrids *T. turgidum* x *T. durum*, *T. durum* x *T. monococcum* and *S. cereale* x *S. montanum***).
Züchter 1936 : **8** : 240–43.
After short notes on the main morphological features of the parent plants and their hybrids, mitosis, as observed in the root-tips of the hybrids, is briefly described. This was mostly regular.
The fertility of the hybrids was then investigated. The hybrids of *T. turgidum* x *T. durum* had 18–20 per cent abortive pollen, those of *T. durum* x *T. monococcum* 95 per cent and those of *S. cereale* x *S. montanum* 75 per cent.

587. 633.11:575.127.5:576.356.5:537.531
Katayama, Y. 633.11 *Aegilops*:575.127.5:581.162.5
(**Cytogenetical investigations in some cereal crop plants and their close relatives.**)
Proc. Crop Sci. Soc. Japan 1936 : **8** : 226–30.
Reciprocal crosses between species and genera involving wheat, *Aegilops* and *Aegilotricum* tended in general to suggest that when plants with high chromosome numbers were used as female parents the set and germination were good. The degree of success in hybridization may be taken to indicate the relationship existing between the plants used in the cross.
Large numbers of haploids were obtained by X-ray irradiation and treatment of the reproductive cells increased the frequency of haploids. Irradiation of the pollen before pollination resulted in 17·6 per cent of haploids.
Haploids from *T. monococcum* were also studied and proved to have one genom only, whereas *Aegilotricum* produced in addition, forms lacking certain chromosomes. Irradiation of reproductive cells of *T. monococcum* resulted in various cytological aberrations affecting the chromosomes and genes and abnormal progeny with various defects.
Examination of seven generations of *Aegilotricum* at first shewed sterility, defective germination and cytological irregularities resulting in haploidy and heteroploidy, whereas in the latest generations fertility increased and the plants were less variable.

588. Čanov, T. V. 633.11:575.127.5:633.14
(**The rye-wheat hybrid 46-131 in the Šatkov region**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. **6** : 44–46.
The hybrid 46–131, produced at Saratov, is extremely winter-hardy and has given yields surpassing those of the standard wheat varieties by 30–35 per cent on a number of different collective farms. It is entirely free from smut attack and has an unusually high tillering capacity. It has large grains of good quality. Further selection is being carried out upon it and it is anticipated that it will be still further improved and by the application of the vernalization method its hardiness still further increased.

589. 633.11:575.127.5:633.14
Kagawa, F. 633.1:576.356:581.331.2:581.036.1
(**The effect of abnormal temperature on the mechanism of pollen formation of the genus hybrids in cereals**).
Proc. Crop Sci. Soc. Japan 1936 : **8** : 117–32.
Various types of cytological aberrations observed under different temperatures in pollen mother cells of the F_1 from *Triticum compactum* Host x *Secale cereale* L. are recorded and their relatively greater frequency as compared with their occurrence in the control material is noted. High temperatures also resulted in the production of large numbers of large pollen grains, the percentage found being about equal to that recorded for dyad pollen grains in the control material.

590. MEISTER, N. G. 633.11:575.127.5:633.14
(Rye-wheat hybrids and their importance in breeding).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 34–36.

Different varieties of wheat gave different results when crossed with the same rye form; all hybrids were largely sterile however, and practical success was only possible on account of the method of natural cross-pollination that could be used at Saratov. The best results were obtained by pollinating the F_1 with wheat, whereby the hybrids gradually approached the wheat type. Various characters unknown in pure wheat appeared in addition. Some of the new forms have proved to be of great practical value from the point of view of yield, disease resistance, grain quality, early maturity, cold and drought resistance and other agronomic characters and some of the best varieties are briefly described.

The amphidiploids have proved to be of insufficiently high quality and hardiness to be used in agriculture, but are being used for crossing with other species and genera.

Since hardy segregates have appeared in the crosses already made, further crosses with other hardier forms of wheat and different forms of rye, including perennial rye, are being tried.

591. SAMOCHWALOW, G. K. 633.11:575.127.5:633.14:581.192
(Analysis of certain chemical characters of rye-wheat hybrids and their parental forms).
Chemisation of Socialistic Agriculture, Moscow 1935 : No. 8 : 85–90.

Analyses of hybrids of the different types and of the parents shewed the hybrids to be nearer to the wheat type than the rye in total nitrogen, the amphidiploid *Secalotricum* being much higher in this respect than the intermediate hybrids of the wheat type. The same was true of the gliadin content, which in the *Secalotricum* parent was even higher than that of the wheat parent. In content of leucosin and albumoses *Secalotricum* stands nearer to the rye parent while the intermediate hybrids again more nearly approach the wheat parent. Both hybrids exceed the parental forms in pentone content.

The gluten of the hybrids was not so white or viscous as the wheat gluten, especially that of the *Secalotricum* hybrid. The starch content of the latter hybrid approached that of wheat, of the intermediate hybrid that of rye; the reverse held in respect of water absorbing capacity. The intermediate hybrid exceeded both parents in pentosan content.

592. KATTERMANN, G. 633.11:575.127.5:633.14:581.44
Genetische Ergebnisse bei Weizenroggenbastarden bis F_4. Mitteilung II. Über anscheinend konstante Bastardformen mit behaartem Halm, ihre Abstammung und ihre Merkmalsverhältnisse. **(Genetic results with wheat x rye hybrids up to F_4. Pt II. On apparently constant hybrid forms with pubescent stem, their origin and their characteristics).**
Pflanzenbau 1936 : **13** : 15–45.

A further analysis of the occurrence of the pubescence character in families in the F_4 and F_5 from wheat x rye hybrids (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 830). In both generations families appeared in which all, or almost all, plants are pubescent; and hereditarily constant forms combining rye and wheat characters may be said to have been obtained. Any subsequent segregation in such constant forms may be attributed to possible cross-pollination, chromosome aberrations or other regroupings of the genes. Constant pubescent progenies were mainly derived from plants with this character strongly marked.

The types segregated were varied.

Other morphological features such as ear type, colour of grain and glumes, awn character and bunt and rust resistance and fertility, etc. were studied. White glume colour predominated markedly, only a few families having only brown glumes; the character appears to shew Mendelian segregation as did also the presence or absence of awns.

As regards fertility in the progenies resembling *T. vulgare*, the set was in general low, but it could be improved by selection of the best progenies, whereas two of the speltoid progenies were distinguished by a relatively high set and quality of grain.

Stem length measurements of the pubescent *vulgare* types confirmed the theory of the co-existence of a stem shortening factor with that for pubescence. The pubescent speltoids

shewed only a small degree of reduction of stem length. Certain data indicate that the speltoid character is dominant to the *vulgare* type, but stem length displays intermediate inheritance.

In pubescent speltoid forms root tips shewed somatic numbers varying from 40 to 45. Though not definitely ascertained, it is suggested that the pubescence gene has been acquired not by crossing over into the wheat genom, but more likely by the addition of rye chromosomes to the wheat genom.

Further cytological investigations are necessary.

A suitable terminology is proposed for constant hybrids such as those in question.

593. Tzitzin, N. V. 633.11:575.127.5:633.289
(My experiments on wheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 3/11 : 62–63.

During the extremely severe drought year 1935, with dust storms and other highly unfavourable conditions, the *Triticum-Agropyrum* hybrids (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 78) grew quite successfully. They also continued to grow when left in pots without watering for over a month, by which treatment the wheat plants were killed off entirely.

Among the hybrids there are hardy annual forms with high yield of large grain with a thousand corn weight of 40–50 grm. and constant perennial forms with a thousand corn weight of 15–20 grm. The yielding capacity of the perennial forms is increasing from year to year and the thousand corn weight has risen in some forms to 25 grms.

Great store is set on these perennial hybrids for cultivation both in the north and in the arid regions of the south.

594. 633.11:575.127.5:633.289
Tzitzin, N. V. 633.11:581.143.26
(The problem of perennial wheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 21–27.

The many valuable qualities of *Agropyrum* that it would be desirable to introduce into wheat are enumerated and the early crossing work with wheat (Cf. "Plant Breeding Abstracts", Vol. IV, Abst. 383, Vol. V, Abst. 78 and Vol. VI, Abst. 833) is summarized. In addition, hybrids with certain forms of *A. repens*, or a species very closely resembling it, have recently been obtained.

The proportion of perennial plants in the later generations varies in the different crosses, the F_4 in some containing up to 60 or 70 per cent of perennials and in others none at all. Many of the annual forms from the fifth and later generations are, however, superior to wheat in yield and in grain quality and are also more disease resistant. Constant forms with the perennial habit and wheat type of grain were obtained in 1934–35. They gave a good yield in the first year and in the second year. They proved very much earlier than in the first year, ripening long before ordinary wheat and hence shewing promise of being an exceedingly valuable type of cereal for northerly and other zones with a short growing season.

Many of the hybrids have inherited the luxuriant root system of the *Agropyrum* parent and are hence much more drought-resistant than wheat; they are in many cases also much hardier and there are indications that the *A. elongatum* hybrids have inherited the tolerance of saline soils characteristic of this species.

595. Veruschkine, S. M. 633.11:575.127.5:633.289
(The prospects of hybridizing wheat with *Agropyrum*).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 28–33.

Crossing wheat with *Agropyrum* is a more promising way of improving it than crossing with rye, *Aegilops* or other grasses, both on account of the greater combination of desirable characters in *Agropyrum* and of the much greater ease of crossing and fertility of the hybrids; e.g. some of the hybrids obtained at Saratov have a fertility of 90 per cent and over. The hybrids *T. vulgare* x *A. elongatum* are particularly fertile and productive. The fertility often increases in the second year of growth and there is a rise with each successive generation. It is thus

possible to work with large populations and so greatly to increase the possibilities of successful breeding. The perennial habit and facility of vegetative reproduction are further assets in this direction and the F_2 can usually be sown on a field scale if required. In view of the remarkable diversity of the hybrids which becomes still greater in the later generations, this is a very great advantage.

The cross with *A. elongatum*, being the most fertile and so capable of self-pollination, thus contains the greatest number of perennial forms. At least one of these has been fixed and is characterized by cold resistance and high yield. It has 2n = 70 chromosomes.

The hybrids from *A. intermedium* contain certain forms with remarkably large grain approaching *T. durum* in size and with very high protein contents, rising to 24 per cent in certain forms. The hybrids are disease-resistant and many give very high yields.

The high degree of chromosome pairing in the hybrids indicates a close relationship between at least some of the genoms in *Agropyrum* and wheat, in consequence of which it ought not to be impossible to combine any desired characters of the two genera. Crosses have also been effected between *Agropyrum* and both *Aegilops* and rye and between wheat and *Agropyrum elongatiforme* (2n = 28) and *Agropyrum junceum* (2n = 42), these new hybrids being in many ways distinct from the earlier ones and of definite interest in many respects.

596. Wakar, B. A. 633.11:575.127.5:633.289:576.356

Cytologische Untersuchung über F_1 der Weizen-Queckengras Bastarde. (**Cytological investigation of the F_1 from the wheat x couch grass hybrids**).

Cytologia, Tokyo 1936 : **7** : 293–312.

F_1 hybrids from *Triticum* and *Agropyrum* species shewed the following somatic chromosome numbers:—*T. vulgare* x *Agropyrum glaucum* 42, *T. vulgare* x *A. elongatum* 56, and *T. durum* x *A. elongatum* 49; while 2n in *A. glaucum* was 42 and in *A. elongatum* 70. The basic number for the genus *Agropyrum* is 7, and the F_1 hybrids mentioned may therefore be regarded as hexaploid, octoploid and heptaploid respectively.

Meiosis, which is fully described, was characterized by considerable deviations from the normal, but in general, it resembled more the type of meiosis found in species hybrids of wheat rather than in generic crosses. That a rather closer degree of relationship between the two *Agropyrum* species and the genus *Triticum* exists than was hitherto believed, is suggested by certain observations, e.g. the occurrence of 14 bivalents (the most frequent number of which was 10), the presence of regular metaphase plates indicating a relatively balanced condition of the chromosome complements, the occasional occurrence of apparently more or less normal pollen grains which may possibly be fertile. In view of such considerations the author suggests that the two *Agropyrum* species referred to might well be regarded as belonging to the genus *Triticum*. Further investigations of these two species and of the other species of *Agropyrum* that do not cross with *Triticum* would be necessary in order to decide the point.

Previous records of similar hybrids are critically reviewed (Cf. "Plant Breeding Abstracts", Vol. VII, Absts. 156 and 833).

597. Šibaev, P. M. 633.11:575.127.5:633.289:664.641.016

(**The quality of the grain in *Agropyrum* and *Triticum-Agropyrum* hybrids**).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 46–48.

Agropyrum grains have been found to contain 5 to 9·5 per cent more gluten than wheat, and bread baked from *A. intermedium*, though somewhat inferior to wheaten bread, was distinctly better than rye bread in volume, porosity and colour. Observations were therefore made on the gluten content of various *Triticum-Agropyrum* hybrids from Saratov, some of which also proved to be distinctly higher than the wheat parents in gluten content.

Gluten was also found in certain other species of *Agropyrum*, *Aegilops* and *Elymus*, but was absent in wild rye (*Secale fragile*) and *Agropyrum cristatum*, which furnishes one more indication of the closer relationship with wheat of the former group of species than the latter. Gluten was, however, found also in wild species of *Hordeum*.

598. Tzitzin, N. V. 633.11:575.127.5:633.289:664.641.016
(What we are working on).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : p. 8.
In connexion with the improvement of the grain quality of the *Triticum-Agropyrum* hybrids (see "Plant Breeding Abstracts", Vol. V, Abst. 78) analyses were also made of the grain of the *Agropyrum* parents, which proved to have quite unusually high protein contents of up to 65 per cent. The grain of the hybrids was distinguished by uncommon ease of milling and high yield of flour; thus from 170 grm. of wheat 102 grm. of flour were obtained, whilst the same quantity of grain of one of the hybrids produced 120 grm. of flour, which is of excellent colour and texture.
The bread from the *Agropyrum* flour was better than rye bread both in colour and flavour and the loaf from some of the hybrids was in size and porosity better than some of the standard wheat varieties and of excellent flavour. Seed enough for 1 hectare or possibly more will be available this year.

599. Müntzing, A. 633.11:575.129:633.14:576.356.5
Über die Entstehungsweise 56 chromosomiger Weizen-Roggen-Bastarde. **(On the mode of origin of 56 chromosome wheat x rye hybrids).**
Züchter 1936 : **8** : 188–91.
Previous records of wheat x rye amphidiploids and the various explanations of their origin put forward by various workers are cited. The author then describes the occurrence among an F_1 from a *Triticum vulgare* x rye cross of two plants with a high proportion of fertile pollen and dehiscent anthers. The fertile pollen grains were remarkably large and from comparison of their measurements with those of pollen grains of rye and of various wheat species are held to contain the chromosome number doubled or many times reduplicated.
The origin of such giant pollen grains is attributed to disturbances in the reduction division. From four ears with dehiscent anthers one grain was set probably as a result of self-pollination. Counts made from the root tips of the resulting plant shewed, as far as could be made out, twice as many chromosomes as the maternal parent, i.e. 56 chromosomes, or very nearly 56. This is presumed to be due to the fertilization of an unreduced egg cell by an unreduced pollen grain.
A similar explanation may, it is believed, apply to many of the other *Triticale* forms that have been known and previously attributed to apomixis instead of self-pollination. (Cf. "Plant Breeding Abstracts", Vol. II, Abst. 594 and Vol. V, Abst. 319).

600. Sapéguine, A. (Sapehin) 633.11:575.243:537.531
(The mutations of hard wheat under the action of X-rays).
J. Inst. Bot. Acad. Sci. Ukraine 1935 : No. 5 (13) : 3–9.
As compared with soft wheat, hard wheat (*Triticum durum*) displays few mutations as a result of X-rays, though certain mutations are very frequently repeated.
The type of the variations in the hard wheat confirm the theory of the specific nature of X-ray mutation in the different biotypes, owing to structural differences between their genoms or in particular chromosomes.

601. Crescini, F. 633.11:575.3
Cambiamento di sementi e modificazioni indotte II. **(The change from winter to spring types and induced modification II).**
Z. Zücht. 1936 : A **21** : 201–08.
In continuation of the work previously reviewed (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 838) it was found that the modification induced by low temperatures before sowing was not inherited.
There was no apparent difference with regard to the time of anthesis between the strains of wheat sown in autumn which had been subjected to low temperatures during the ripening of the grain and the controls.

The application of low temperatures during the period of grain development increased the germination during the resting period.
A cumulative effect was noticed in pure lines of the variety Dodici with regard to the adaptation to spring sowing.

602. Afanassjeva, A. S. 633.11:576.312.36:537.531
Die Wirkung der Röntgenstrahlen auf die Zellelemente von Sommerweizen (*Triticum vulgare* var. *caesium* 0111). [**The effect of X-rays on the cell elements of spring wheat (*T. vulgare* var. *caesium* 0111)**].
Protoplasma 1936 : **25** : 77–91.
A German version of the work reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 170.

603. Buchinger, A. 633.11:576.341:575.42
Die Saugkraft als Selektionsfaktor in der Weizenzüchtung mit besonderer Berücksichtigung grundlegender Fragen auf dem Gebiete der Saugkraftbestimmung. (**Suction force as a factor in selection in wheat breeding with special regard to the basic problems concerning the determination of suction force**).
Z. Zücht. 1936 : A **21** : 148–200.
The data on suction force in plants is reviewed and a special section devoted to the results of experiments on selection by means of suction force for five generations.
The wheat used was a land race of *T. vulgare*.
The grains of roughly equal size, shape and weight were selected only on a basis of suction pressure.
The results shewed a marked increase in yield over the unselected plants though the quality remained practically unaltered.
A pure line is shewn, by this method of selection, to be composed of "physiological lines" with varying suction force.

604. 633.11:576.356.5:575.127.2
Matsumura, S. 633.11:576.354.46:581.162.5
Weitere Untersuchungen über die pentaploiden *Triticum*-Bastarde V. Beziehungen zwischen Chromosomenzahlen und Sterilität sowie einigen morphologischen Eigenschaften in der F_2-Generation des Bastardes *T. polonicum* x *T. Spelta*. (**Further investigations on pentaploid *Triticum* hybrids V. Relations between chromosome number and sterility as well as some morphological characteristics in the F_2 generation of the hybrid *T. polonicum* x *T. Spelta***).
Jap. J. Bot. 1936 : **8** : 65–83.

Matsumura, S.
Genetische Studien über die pentaploiden Weizenbastarde. I. Vererbung der von den Chromosomenzahlen abhängigen morphologischen Eigenschaften bei der Verbindung *Triticum polonicum* x *T. Spelta*. (**Genetical studies on pentaploid wheat hybrids. I. Inheritance of the morphological characters depending on chromosome numbers in the combination *T. polonicum* x *T. Spelta***).
Jap. J. Genet. 1936 : **12** : 123–36.
In making the necessary crosses for the first of these two investigations it was found that when the spelt wheat was used as the pollen parent the set was much better than in the reciprocal cross.
The frequency of the various chromosome numbers in the F_2 consisting of 675 individuals from the pentaploid hybrid between *T. polonicum* var. *vestitum* Körn. and *T. Spelta* var. *Duhamelianum* Körn. was investigated and the distribution of the numbers from 28 to 42 appears to approximate closely to a random dispersal in contrast to the findings of other workers, whose results invariably shewed a remarkable deficiency in the numbers of plants

with intermediate chromosome numbers as compared with the expected number—a result attributed by the writer to the use of insufficient data for statistical treatment.
In the present experiments a certain skewness in the frequency curve indicating a preponderance of 36–42 chromosome plants as compared with the 28–34 chromosome individuals is, in the author's opinion, explicable on various grounds.
A study of the relation between chromosome numbers and sterility suggested that fertility was dependent upon chromosome number. The classes with 29-34 chromosomes shew a large number of plants of high sterility, while in the 35 chromosome group a fairly large number of satisfactorily fertile plants occur. Also the increase in the numbers of fertile plants in the 35–42 chromosome class was correlated with increased chromosome number whereas the reverse holds for the 29–34 chromosome group. Among the 40, 41 and 42 chromosome plants fully fertile forms, equal to the parents, were found.
Correlations were also noted between chromosome association (relative number of bivalents and univalents present) and sterility. In the plants with chromosome associations tending to produce sterility, fertility decreased as the number of bivalents decreased: while in individuals with identical chromosome number (e.g. in the 36 chromosome plants) fertility increased as the number of univalents increased.
The factors for awnedness and pubescent node were found to be linked and must lie in the *A* or *B* genom. The unawned and the pubescent condition were dominant to their respective allelomorphs. Moreover, for pubescent node, certain modifying factors appear to be operating.
The density of the ears appeared to be closely related to chromosome number and was found to decrease with the number of spelt chromosomes present, especially in the low chromosome number group. Plants with solid straw belong to the small chromosome number group or represent sterile chromosome combinations. The genes for the lax ear of *T. Spelta* and the gene for hollow straw lie in the spelt genom *D*.
The second paper reports that confirmation of the above results was obtained from a study of reciprocal back-crosses of the F_1 hybrids to both parents. (Cf. also "Plant Breeding Abstracts", Vol. VI, Abst. 1205).

605. YAMAMOTO, Y. 633.11:576.356.5:581.481
Über das Vorkommen von triploiden Pflanzen bei Mehrlingskeimlingen von *Triticum vulgare* Vill. (**On the occurrence of triploid plants in multiple seedlings of *T. vulgare* Vill.**).
Cytologia, Tokyo 1936 : **7** : 431–36.

Instances are given of multiple seedlings occurring in Japanese varieties and comprising triploid individuals, e.g. a triplet composed of 2 triploids and a diploid, 18 twins composed of a triploid and a diploid. The morphological characteristics are described with notes on the cytological peculiarities of a triploid individual (2n = 63). A marked tendency to trivalent formation existed but rarely attained 21.
About 30 per cent of the pollen appeared good and pollination of a triploid with pollen from diploids gave a set of 68.8 per cent. Selfing gave a set of 21·4 per cent and open pollination 25 per cent. Pollination of a diploid plant with pollen from a triploid gave no set.
The possible role of the endosperm in the origin of such multiple seedlings is considered. The fact that twins consisting of triploid and diploid were much more frequent than a haploid in conjunction with a diploid suggests that in certain races the endosperm has a definite tendency to develop seedlings, while the development of the unfertilized haploid embryo sac nuclei of such races is rare.

606. YAMASAKI, Y. 633.11:576.356.52:576.354.46
Some observations on the microsporogenesis of the haploid plant of *Triticum vulgare* Host.
Jap. J. Bot. 1936 : **8** : 151–53.

Of 964 pollen mother cells examined in the haploids from Shiromansaku x Akakomugi No. 3, 460 shewed 21 univalents, 353 had one bivalent, 5 had one trivalent, 116 had two bivalents, 3 had one bivalent and one trivalent, 22 had three bivalents, 1 had two bivalents and one trivalent and 4 had four bivalents; 11 of these cells shewed ring bivalents.

607. 633.11:578.088.1
633.11:575:581.192

Bericht über die fünfzigste Generalversammlung der Deutschen Botanischen Gesellschaft in Erlangen, Juli, 1936. (**Report of the 50th General Meeting of the German Botanical Society in Erlangen, July 1936**). Ber. dtsch. bot. Ges. 1936 : **54** : (1)–(20).

Comprises *inter alia* report on work already referred to in "Plant Breeding Abstracts" on methods of identifying varieties of wheat by the phenol test, carotin content, germination, etc. (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 148).

608. Vinogradova, E. 633.11:581.162.3:578.08

(**Results of pollinating wheat by the Krasnodar method**).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 1 : 59–60.

The method described by Luk'janenko (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 325) gave much better results than the ordinary method of pollination, a set of 80 per cent being obtained in some crosses as compared with 10 per cent with the common method; though in other crosses the difference was not quite so marked, the further application of the method, also to interspecific and intergeneric crosses, is recommended.

609. Kihara, H. 633.11:581.481:576.356.5

(**A diplo-haploid twin plant in *Triticum durum***).

Agric. and Hort. Japan 1936 : **11** : 1425–34.

Out of seven twin plants one proved to be a diplo-haploid pair. In the haploid from 0–3 bivalents were found at metaphase I; but the occurrence of univalents alone was the most frequent configuration and their distribution between 2 + 12 and 7 + 7 to the poles was entirely a random one.

In the haploid plant the maturation divisions resembled those recorded for many hybrids, with numerous univalents. Restitution nuclei with, in some cases, a complete complement of chromosomes were formed.

With open pollination the fertility of the haploid plant was 4·3 per cent.

610. Frenkel, A. Ja. 633.11–1.524

(**The world collection of wheats of the Institute of Plant Industry as initial material in breeding**).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 3 : 78–85.

In many parts of the U.S.S.R. the most successful way of wheat improvement for the present is selection in the local races, by which means most of the best varieties have so far been obtained, including many of the best varieties of other countries such as the U.S.A., which have been produced from local Russian wheats. Further improvement will be based on the world wheat collection, which now contains 32,000 forms from all wheat-growing countries of the world and embraces fifteen distinct species, with 650 botanical varieties. From these a "type collection", representing all the main types existing, is being made; this is to consist not only of the most promising types, since it is known that by hybridization very desirable progeny can at times be obtained from unprepossessing parents. Some of the types are on the other hand suitable for immediate cultivation in certain areas without further breeding.

611. Jakubziner, M. M. 633.11–1.524.4

(**New varieties of wheat from the world's resources**).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 37–44.

The author mentions instances where the wheats of one country have been successfully introduced into other countries and points out that most, if not all, of the successful new Russian varieties have been produced by either selection or hybridization with varieties introduced from other countries, and especially the varieties Huron, Preston, Garnet and others;

among the *T. durum* forms those of the variety *horanicum* from Syria and the Transjordan (Cf. "Plant Breeding Abstracts", Vol. III, Abst. 373) are especially promising and a brief description of them is given. Among other interesting features they possess resistance to disease and to drought, lodging and shedding. They are very varied in type and some of them have been introduced directly into cultivation as well as being extensively used in hybridization.

612. 633.11 *T. durum*:631.524.4

NAVOLOTSKII, A. V. 633.11 *T. durum*:575(47)

(Cultivation of *Triticum durum* in the U.S.S.R. and its importance for increasing yield).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 6–16.

An emphatic recommendation of *T. durum* is made on the grounds of its high yield when grown under suitable conditions of cultivation, especially when vernalization is applied.

Under the heading breeding it is pointed out that considerable improvement can be and has been brought about simply by pure line selection. Still further advances can be attained by hybridization on the basis of the world collection of *T. durum*, in which numbers of unusually valuable characters and combinations of characters have been discovered. Thus from Cyprus early forms with low straw and resistance to frit fly have been obtained; from Asia Minor large-grained early forms resistant to *Fusarium*; from Egypt early forms with low, strong straw; from Spain and North Africa highly productive forms characterized by high tillering capacity, leafiness, size of grain, resistance to rust and late maturity; from the mountains of Arabia forms of record earliness and low habit; from Iran and Transcaucasia winter forms with tall straw, large grain and high yield; and from Abyssinia awnless forms of early maturity, reacting to length of day. All these forms will be useful in hybridization and crosses should be made with other species both of the 28 and 42 chromosome series. Especially promising results have been obtained from crosses with *T. persicum*, *T. dicoccum*, *T. turgidum* and *T. vulgare*.

613. TUMANJAN, M. G. 633.11–1.524.4(56.6)

(Wild wheats of Armenia).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 4/12 : p. 67 ; also Pravda 1935 : 16th October.

Reference is made to the quality of new forms and species of wild wheats found in Armenia, for the preservation of which a special officer has now been sanctioned.

614. 633.11–2–1.521.6
633.13–2–1.521.6

SIDOROV, F. F. 633.491–2–1.521.6

(Work on immunity).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 20–26.

Studies of the world collection of wheats have shewn that certain species are resistant to groups of diseases. This is illustrated by a table shewing the reaction of the different species to a number of different diseases and pests. Many promising hybrids have been obtained including hybrids of *T. Timopheevi* (see "Plant Breeding Abstracts", Vol. V, Abst. 649) with *T. vulgare* and *T. durum* and crosses within *T. vulgare*. Strains resistant to frit fly have been selected from Huron and from certain of the Siberian wheats and the hybrids of *T. Timopheevi* are also of great interest in this respect.

Similar data on complex immunity are provided for oats, where the chief interest is centred in *A. byzantina*, which is resistant to the main diseases and crosses well with cultivated varieties. The behaviour of the immunity of this species in inheritance varied according to the other species with which it was crossed. The presence of a number of forms of oat smut in Russia has been demonstrated.

Resistance or immunity to blight has now been found in nine primitive potato species, namely *Solanum demissum*, *S. semidemissum*, *S. verrucosum*, *S. Antipoviczii*, *S. ajuscoense*, *S. Vallis-Mexici*, *S. polyadenium*, *S. coyacanum* and *S. bulbocastanum*. So far only *S. demissum* and

S. Antipoviczii have given desirable hybrids, some of which possess a very promising combination of high yield and resistance, which in many of them is also shared by the tubers. In various other qualities, however, they are deficient and further selection will be required. The hybrids with *S. Antipoviczii* cannot be selfed as the *S. demissum* hybrids can, but must be back-crossed with the domestic potato for one or two generations before being selfed.
Investigations on disease resistance in flax and other plants are also in progress.

615. 633.11–2.111–1.521.6
KOLOMYCEV, G. G. 633.11:575.42"793"
Winter-hardiness and earliness of wheats.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1936 : III (XII) : 351–56.
The length of the first internode and of the first true leaf is shewn to be less in winter-hardy than in tender varieties and even within an apparently "pure" variety improvement of hardiness can be effected by selecting the individuals with the shortest nodes and leaves. The differences were more evident when the plants were grown at a low temperature.
On the other hand the forms in which the first-formed elements are largest prove to be the earliest in maturity and selection for earliness can be based on this.

616. *BUILIN, D. P. 633.11–2.111–1.521.6:575(47)
(**New varieties of winter wheat**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 68–70.
Descriptions are given of a number of newly released hybrids possessed of great resistance to frost and high grain quality.
All the varieties described are superior to *Lutescens* 0329 also in drought resistance.

617. SALTYKOVSKIJ, M. I. 633.11–2.111–1.521.6:575.11
Cold resistance of the first generation of wheat hybrids.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1936 : **3** (XII) : 235–38.
The relative hardiness of a number of the wheats grown round Saratov is reported. All the wheats mentioned, both winter and spring varieties, were unaffected by cold treatment (thermo-stage) and responded in their development only to light treatment (photo-stage). The resistance of the F_1 hybrids between a winter variety and different spring wheats varied with the length of the photo-stage of the spring parent; the hardiness of hybrids of the same spring form with different winter wheats varied with the hardiness of the latter. Other hybrids were mostly intermediate between the parents.
It is assumed that the later generations will maintain the same degree of winter-hardiness.
Both the thermo- and photo-stages appear to affect cold resistance and it is concluded that by suitable crosses forms can be obtained which in hardiness greatly exceed both parents.
The behaviour of the *Agropyrum* hybrids was similar to that of wheat hybrids, the hardiest being the hybrids of winter wheat with *Agropyrum*.

618. LAUMONT, P. 633.11–2.19–1.521.6:575
Le mitadinage des blés. (**Yellow berry in wheats**).
Bull. Docum. Renseign. Agric. Alger. 1934 : No. 3 : (N.S.) : Pp. 15.
What is known of the condition of yellow berry and its cause and the chemical composition of affected grains is stated. Apparently the affection is most frequently found in the lowermost and uppermost portions of the ear and in the innermost florets of the most fertile spikelets. Conditions of soil and climate also affect the occurrence of the defect.
Investigations on the possible hereditary nature of tendency to yellow berry carried out with two selected lines of hard wheat Tlemcen No. 277 and Tessalah No. 294 shewed that by continued selection two new lines, P.5 and N.14, more resistant to yellow berry than the original lines were obtained. Cultural methods and breeding are recommended as ways of reducing this defect.

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* An extended summary of this paper is on file at the Bureau.

619. 633.11–2.451.2–1.521.6:575(47)
ŠEKHURDIN, A. P. 633.11–2.452–1.521.6:575(47)
(Breeding spring wheat for resistance to smut and to brown rust).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 1 : 19–24.
Out of 92 of the new wheat varieties tested with artificial infection of *Ustilago nuda* only three proved resistant, namely the awnless *T. durum subaustrale* 38, *T. durum hordeiforme* line 05866 and *T. vulgare erythrospermum* 78/01. The latter variety is a hybrid between hard (Beloturka) and soft (Poltavka) wheats. Many of the varieties attacked normally remain free under natural conditions; one of these, *Lutescens* 55 11 is interesting as being one of the few varieties to combine resistance with a high yield; it exceeds the standard 062 in yield and is being multiplied for distribution. Resistance under both natural and artificial conditions was found also in some of the earlier hybrids of Kooperatorka and others, and some of these also exceeded the standard in yield, e.g. *Erythrospermum* 431, by 19·1 per cent.
A number of resistant forms of spring wheat have also been produced, and other lines shewing a combination of high yield and resistance to brown rust have been obtained; certain of these also possess a certain amount of resistance to stem rust and are free from smut in the field.

620. STARKOV, A. A. 633.11–2.452–1.521.6
(New high-yielding rust-resistant varieties of winter wheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 66–68.
The merits and resistance of a number of varieties and hybrids are discussed. The new winter hybrid Kanred x Fulcaster No. 266287 is very promising, having exceeded Ukrainka by 64 per cent in yield, with 20·1 centners per ha. as opposed to 12·3 in 1935.

621. 633.11–2.452–1.521.6:575(77.6)
HAYES, H. K. et al. 633.11 Thatcher
Thatcher wheat.
Bull. Minn. Agric. Exp. Sta. 1936 : No. 325 : Pp. 39.
Thatcher is a hard, red, spring wheat bred by the Minnesota Agricultural Experiment Station in co-operation with United States Department of Agriculture, Bureau of Plant Industry, the aim of the work having been to produce a spring wheat resistant to stem rust (*Puccinia graminis tritici*), of desirable agronomic type and of high quality for milling and baking. The data on its performance in numerous tests, presented in this bulletin, indicate that Thatcher fulfils these needs. It is moreover highly resistant to lodging, moderately resistant to bunt and resistant to scab and black chaff. It is susceptible to leaf rust.
One of its parents is a segregate from the cross Marquis x Iumillo, combining the field resistance to stem rust of the *durum* parent with a spike of the common wheat type. The other parent was a selection from the cross Kanred x Marquis, selected because of its uniform habit of growth, desirable field appearance and seedling resistance to the physiological forms of rust from which Kanred is immune. Thatcher combines the two types of resistance, which are inherited independently. In other respects it closely resembles Marquis except that its spike is more compact and sometimes slightly crooked.

622. KALÉ, F. 633.11–2.452–1.521.6:578.081
Résistance relative des blés au *Puccinia glumarum* Eriks. et Henn. dans la région Versaillaise. **(The relative resistance of wheats to *P. glumarum* Eriks. et Henn. in the district of Versailles).**
Ann. Epiphyt. Phytogénét. 1936 : **2** : (N.S.) : 13–19.
The author describes a method for the injection of the living cell with indicators. The reaction — phenol red was most used — on a number of varieties of wheat was found to agree with the relative resistance of the variety to yellow rust.

623. Rademacher, B. and Klee, H. 633.11–2.7–1.521.6:575
Herabminderung der Schäden durch die Weizengallmücken *Contarinia tritici* Kirby und *Sitodiplosis mosellana* Géhin auf dem Wege der Sortenwahl und Züchtung. (**Reduction of the damage by the wheat gall midges *C. tritici* Kirby and *S. mosellana* Géhin by means of variety selection and breeding**).
Z. Zücht. 1936 : A **21** : 209–36.

As was expected, no immune variety was found. Differences in the degree of severity of the attack were found which were partly due to the seasonal condition, but also partly inheritable. The variety Marquardts, a brown glumed winter wheat, proved to have a high resistance which appeared to be of a mechanical nature.

624. Greisenegger, I. K. 633.11:664.641.016
Die Eigenschaften der Weizen und deren Beziehungen zueinander. (**The characters of wheat and their mutual relationships**).
Pflanzenbau 1936 : **13** : 49–78.

Winter wheats numbering 446 and spring forms totalling 138 from the harvests of 1934 and 1935, and comprising a large number of varieties grown under different conditions of soil and climate were used as material in this investigation. The main object in view was to ascertain the correlations if any existing between various characters, such as baking value (as determined by the farinograph), hectolitre and thousand corn weight, vitreousness, wet and dry gluten content, etc. and especially between external characters such as colour, gloss and feel and baking value. The characterization of the winter and spring groups of wheat as regards these various features is also dealt with.

Clearly marked positive correlations were noted between dry and wet gluten contents on the one hand and baking values on the other. Also a close relationship was observed between the percentages of vitreous grains and the gluten contents and the former characteristic can therefore be justifiably regarded as a measure of quality. Wet and dry gluten contents shewed a marked, though not absolutely parallel relationship, whilst baking values, gluten contents and vitreousness were almost independent of hectolitre weight and a slight negative correlation was noted between hectolitre weight and thousand corn weight.

In general, it may be said that for wheats grown under normal conditions, the physical characteristics of colour, gloss and feel may offer valuable evidence whereby the quality of the grain may be determined.

625. Laumont, M. 633.11:664.641.016
Exposé sur les blés de force. (**Dissertation on high quality wheats**).
Chambre Agric. Alger (1935) 1936 : Sess. Ord. de Novembre : Pp. 12.

An address explaining the opening that exists on the French market for high quality wheats from Northern Africa.

The various changes in the popularity of the local and French varieties of wheat grown in Algeria are outlined with due reference to the well-known Pusa and Florence-Aurore groups originally obtained from Pusa stock and from a second generation hybrid from Tunis respectively. Florence-Aurore 588 which had deteriorated is being re-selected at Maison Carrée and in the meantime a number of new hybrids Pusa and Florence obtained from Tunis are being cultivated; in 1929 a cross was made with Florence 290 and Pusa No. 4, from which a number of fixed types with high yield and quality have been obtained. A number of hybrids have also been bred from selections from local wheats crossed by strong wheats or those of high baking value; such are Florence Mahon 7356, Pusa Mahon 7760 and Hindi Mahon 7277.

A warning is given as to the requirements of the wheats so far produced in regard to soil and climate.

626. Murav'ev, P. A. 633.11:664.641.016
(New developments in the determination of baking quality in varieties of wheat).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 60–65.
It is shewn that with the introduction of "improvers" the problem of baking quality has been distinctly simplified, having come to depend almost exclusively on the quantity and physical properties of the gluten.

627. Šibaev, P. N. 633.11:664.641.016:575
(Variation in the baking quality of wheats in hybridization).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 1 : 32–36.
Methods of analysing the quality of flour on samples of grain weighing as little as 150 grm. have been devised at Saratov. This enabled observations to be made on quality in a large number of hybrid populations, in many cases as early as the F_4. Distinct correlation was observed between the quality of the progenies and that of the parental varieties, except in the case of crosses between *T. durum* and *T. vulgare*, where the progenies were of a higher quality than would be expected from the quality of their parents. The new varieties produced at the Saratov station, Sarrubra and Sarrosa, were among the segregates from such crosses. The macaroni quality of some of the complex hybrids has also proved higher than that of *T. durum* itself.
Even in certain crosses within *T. vulgare* the quality of some of the segregates was greater than that of the parents, shewing the complexity of this character.

628. Åkerman, Å. 633.11:664.641.016:575(48.5)
Die Verbesserung der Backfähigkeit des schwedischen Weizens durch Züchtung. **(The improvement of the baking quality of Swedish wheat by breeding).**
Züchter 1936 : **8** : 174–79.
A concise outline of the lines along which the improvement of the baking quality of Swedish wheat has proceeded during the past 50 years with notes on various crosses of Swedish and foreign forms, from which the numerous new wheats of the present time have originated.

629. 633.11:664.641.016:575(65)
Ducellier, L. 633.11 Cailloux
La production des blés de qualité en Algérie. **(The production of high quality wheats in Algeria).**
Bull. Soc. Agric. Algérie 1934 : **77** : 39–55.
A review is given of the earliest attempts to define and estimate wheat quality, terminating with the extensimeter method of Chopin. The value of a number of different varieties estimated by this method when grown in Algeria is given, the other features of the varieties being also briefly indicated. The varieties include certain wheats introduced from India and Australia and also certain new hybrids produced in France. Among these are a hybrid made by Schribaux, from Florence x Aurore and selected in Tunis by Boeuf on the basis of its yield, earliness and resistance to rust; further selection is being carried out on the variety, which though still segregating has been named Cailloux. Some of the new selections are distinguished by further desirable features such as standing capacity, and have given good results as regards quality.
Similar selections from a cross Pusa x Florence have proved still more promising, especially in quality.
A cross Florence 290 x Pusa 4, made in Algeria in 1929, has given certain segregates which in quality and yield are of some promise and crosses have also been carried out between the best lines of the local wheat Mahon and early wheats from India, in the hope of producing wheats which, though not so early as Florence and Pusa, will be resistant to late frosts and to hot winds, as well as possessing strong straw and suitable quality.

630. Cortabarria, E. J. 633.11:664.641.016:578.081
La prueba del "tiempo de fermentacion" en el analisis de los trigos. (**The whole meal fermentation time tests of wheats**).
Arch. Fitotécn. Uruguay 1936 : **1** : 388–94.
Examinations on three pedigree wheats shewed that variations within the variety could be statistically greater than the differences between varieties. Nevertheless the differences between varieties were in agreement in two independent sets of observations.

631. Lindberg, J. E. and Kajmer, H. 633.11:664.641.016:578.081
Zur Qualitätsbeurteilung des Weizens. (**On the determination of quality in wheat**).
Züchter 1936 : **8** : 191–96.
On methods used in determining baking value in Sweden. A bibliography is appended.

632. Mueller, G. 633.11:664.641.016:578.081
Der heutige Stand der Mehlqualitätsbewertung mittels physikalischer Messverfahren. (**The present position of flour quality determination by physical methods**).
Z. ges. Getreidew. 1936 : **23** : 104–16.
A useful review is given of the modern conceptions of flour quality and the methods of determining it.

633. Schribaux. 633.11:664.641.016:578.081
Méthodes d'appréciation des blés. (**Methods of testing wheat quality**).
C.R. Acad. Agric. Fr. 1936 : **22** : p. 768.

Boeuf. and Matweeff, M.
Observation sur l'appréciation des blés a l'extensimètre (méthode Chopin) causes systématiques de variabilité. (Conclusions). [**Observations on the testing of wheat by the extensimeter (Chopin's method), variability due to technique. (Conclusions)**].
C.R. Acad. Agric. Fr. 1936 : **22** : p. 769.

Miège.
A propos de la méthode Pelshenke. (Conclusions). [**On the Pelshenke method. (Conclusions)**].
C.R. Acad. Agric. Fr. 1936 : **22** : p. 770.
On the conclusions extracted from the reports of the authors on a series of analyses made to test the practical value of the methods of Chopin and of Pelshenke.

634. Ducellier, L. 633.11 *Aegilops*:575.127.5:633.11
Quelques observations sur *l'Aegilops ventricosa* Tausch et son hybridation naturelle en Algérie avec le blé. (**Some observations on *Ae. ventricosa* Tausch and its natural hybridization with wheat in Algeria**).
Bull. Soc. Hist. Nat. Afr. N. 1935 : **26** : 156–72.
The distribution of the species *Ae. ventricosa* Tausch, and of a number of its different varieties in various countries, including Northern Africa, is recorded with notes on the types of habitat and variations observed in the plant in different regions and also on the occurrence of *Ae. triticoides* and the hybrid *Ae. Triticum Rodeti* which has been assumed to be a cross of *Ae. ventricosa* by hard wheat (*Triticum durum* Desf.), though proof has not yet been possible as all the hybrids so far found have been sterile.
Records of various other crosses between *Aegilops* and wheat species are very briefly referred to. The author considers that the cross of hard wheat by *Ae. ventricosa* should be more difficult than the reciprocal owing to the mechanical difficulty of upward transportation of the pollen by the wind.
There is a bibliography consisting mainly of the earlier literature on the subject.

BUCKWHEAT 633.12

635. Šubina, A. F. 633.12:575.14
(Inbreeding in buckwheat breeding).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 3 : 66–71.

Loss of vigour was observed on continued inbreeding but self-pollination was perfectly possible. A uniform progeny was obtained in many cases by F_4 or earlier. Inbreeding disclosed a most unexpected variety of forms, both as regards plant and grain characters. Some were sterile. Crosses are to be made between the inbred lines.

OATS 633.13

636. Malygin, Ju. N. 633.13:575(47)
(New varieties of oats bred at Moscow).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 4/12 : 63–66.

By crossing together the best of the earlier varieties produced by the station new lines with better yielding capacity have been produced. The line with the highest yield, G-5001, has proved too weak in the straw for regions where the risk of lodging is high, but is suitable for other places. Line G-4971 is distinguished by a high and regular yield and good standing capacity, with large white grain of the Swedish type, of good market value.
Intensive selection of the local oats has been carried on since 1931 and in 1935 two improved lines had been isolated, lines $A\text{-}500_V$ and $A\text{-}5465_{III}$. The latter is small in the grain but definitely superior to the standard variety A-0315 in agronomic characters.
A new improved naked oat, A-5321, obtained by similar selection, has been released; it is somewhat inferior to the standard in yield, especially on poor soils, but its naked grain makes it worth growing for certain purposes in spite of this.
Improved varieties for hay making have also been selected.

637. Nishiyama, I. 633.13:575.127.2:581.162.5:537.531
[Experimental embryological studies on tetraploid *Avena* hybrids (2x x 6x)].
Bull. Seric. Silk Industr., Uyeda 1935 : **8** : 378–82.

The unduly strong stimulating action of the male nucleus in crosses between the diploid *A. strigosa* as female and the hexaploids *A. fatua*, *A. sativa* and *A. sterilis* (Cf. "Plant Breeding Abstracts", Vol. III, Abst. 204) was found to be reduced by X-ray irradiation of the pollen. One of the apparently good seeds obtained by this method germinated, but the seedling, which was tetraploid, died.

638. 633.13:575.242
Alabouvette, L. and Friedberg, R. 633.13:575.127.2:575.11
Étude de quelques avoines fatuoïdes. **(A study of some fatuoid oats).**
Ann. Épiphyt. Phytogénét. (1934/35) : 1936 : **1** : (N.S.) : 1–21.

The natural crossing, mutation and chromosome aberration hypotheses of the origin of fatuoid oats are reviewed.
Homozygous fatuoids have been observed at the plant breeding station, Versailles, in the varieties XXI_2, Aigle, Lyngley Heath oat and Frühhafer. The fatuoid in the variety Aigle was partially sterile; the others appeared to belong to Huskin's type A.
The origin and subsequent behaviour of the XXI_2 fatuoid was observed in some detail. It arose as a homozygous fatuoid and its sister plants bred true to *sativa* characters, indicating that it was not the product of natural crossing. When crossed with the normal parent line XXI_2, the F_1 was intermediate in respect of the grain characters concerned and 1 : 2 : 1 segregation was observed in F_2 and confirmed in F_3. The untreated grains of the XXI_2 fatuoid were intermediate in speed of germination between XXI_2 and *Avena fatua*, but when dehulled germinated as quickly as XXI_2. The fatuoid had 42 somatic chromosomes.

The results of a cross between *A. fatua* and the variety von Lochow are reported. Comparison of these with the behaviour of XXI_2 and its fatuoid also suggested that the fatuoid did not arise by natural crossing. No evidence was obtained of bifactorial inheritance of *sativa* vs. *fatua* characters, as reported by Tschermak.
Of the two remaining hypotheses to explain the origin of XXI_2 fatuoid, the author inclines to the mutation theory.

639. Johnson, L. P. V. 633.13:575.242:581.162.32
The origin of fatuoid oats with particular reference to a hybridization theory.
Northw. Sci. 1936 : May : Pp. 8.
A somewhat condensed account of the work reviewed in "Plant Breeding Abstracts", Vol. V, Abst. 559.

640. Milatz, R. 633.13:578.087
Der Hafer im Sortenregister (Merkmal- und Sortenkunde). [**Oats in the variety catalogue (science of characters and varieties)**].
Landw. Jb. 1936 : **83** : 1–152.
An exhaustive study of the varietal characteristics in oats, together with descriptions of a large number of varieties existing in commerce in 1936. A table is given of the 1935 varieties shewing their origin and breeders and much other useful information is given in tabular form, including a genealogical table shewing the parentage and relationship of all the main varieties, a bibliography of 98 references and a number of illustrations.

641. Zagorodnjak, Ja. F. 633.13:581.46:575
(**Varieties of naked oats**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 4 : 51–52.
By crossing naked oats of widely different geographical origin two varieties have been produced which equal the standard oat variety in yield of hulled grain, the grains being also larger than the hulled grains of the standard variety. The straw yield was also not inferior to the standard and they are slightly earlier in maturity.

642. 633.13–1.524.4:575(48.5)
Granhall, I. 633.13–2.7–1.521.6
Untersuchungen an schwedischen Landsorten von Hafer. (**Investigations on Swedish local varieties of oats**).
Züchter 1936 : **8** : 211–14.
A brief account of the early Swedish indigenous oats followed by an analysis of three populations of the local types in 1929–35, according to features such as grain colour, spikelets, awns, 1,000 corn weight, stem length, etc. Great variation was observed and many types were of interest from the breeding standpoint, though not suitable for actual cultivation, when compared with modern varieties. Many lines of the local oats were superior to the Probsteier varieties in tillering capacity and resistance to frit fly larvae.
A fuller report is to follow.

RYE 633.14

643. 633.14:575(47)
Krasnjuk, A. A. 633.14:575.14
(**Preliminary results and prospects of breeding work with rye**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 42–45.
By individual family selection from Eliseevskaja rye a new variety has been produced, Saratov No. 1, exceeding Eliseevskaja by 21 per cent in yield and also superior in size of grain and yield of flour. Two new hybrid varieties have also given good results.

Inbreeding has also been carried out and the method of performing it is described. In the first place the best plants not shewing reduction in vigour are selected; in addition a certain number of plants reduced in vigour but possessing certain useful characteristics are selected for crossing among themselves. Certain combinations or groups of plants are allowed to cross-pollinate naturally.
By these methods, improved lines exceeding the standard by 26·3 per cent in yield were obtained; the grain was also better filled and the new lines were hardier.

644. Breslavetz, L. P., 633.14:575.24:537.531
Medwedewa, G. B. and Afanassjewa, A. S. 633.14:581.03
(Increasing yield in rye by X-ray irradiation).
Kosmos, Lwów 1936 : **8** : p. 288.
An article dealing with the matter reviewed in "Plant Breeding Abstracts", Vol. VI, Abst. 1240.

645. Frimmel, F. and Baránek, J. 633.14:575.4
(New trends in rye breeding.)
Zem. Pokrok. 1935 : **2** : 57–58.
A brief description of the "Miss America" selection process which has proved of value in rye breeding and in other cross-pollinated plants. It is fully described in the article referred to in "Plant Breeding Abstracts", Vol. V, Abst. 685.

646. Andersson, G. 633.14–2.111–1.521.6
Gefrier- und Abhärtungsversuche mit Roggen. **(Freezing and hardening experiments with rye).**
Züchter 1936 : **8** : 214–17.
Further work along the lines already reviewed (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 999) is suggested, with remarks on the questions of technique and the possible physiological and biochemical basis of varietal differences in winter-hardiness and cold resistance. Experiments shewed that when care was taken in the actual carrying out of the cold resistance laboratory tests, reliable results were obtained agreeing well with those recorded for winter-hardiness in field tests.

647. Linnik, G. I. and Smirnitskaja, M. I. 633.14–2.111–1.521.6
(Breeding the variety Petkus 950 for winter-hardiness in the years 1930-1934).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 64–70.
Tests of a strain of Petkus rye that had been selected for winter-hardiness for a number of years shewed the strain to be distinctly superior in this respect and to give greatly enhanced yields in consequence. Selection was carried out on poor, unmanured ground in order to eliminate the less sturdy individuals and sowing was delayed for the same purpose. Part of the material was also grown in boxes and subjected to specially low temperatures. Mass selection was used at first, later modified to individual plant selection on a large scale, the selected plants being grown mixed.

MAIZE 633.15

648. 633.15 Iowealth
Smith, S. N. 633.15–2.183–1.521.6:575.12
A hybrid corn which is resistant to wind damage in the fields.
Seed World 1936 : **39**(7) : p. 14.
Tests of hereditary differences in the wind resistance of 2,435 strains of hybrid and open pollinated maize in Iowa shewed that one hybrid, Iowealth, was entirely windproof under all conditions.
The causes of susceptibility to wind damage and of the losses due to the defect are described. The remedy is to breed for a strong, tough stalk and a deep root system.

649. 633.15 Nostrano dell'Isole
633.15 Finardi
Tosi, G. M. 633.15:575.42(45)
Il granoturco "Nostrano dell'Isole" e la selezione "Finardi". (**The maize "Nostrano dell'Isole" and the selection "Finardi"**).
G. Agric. Domen. 1934 : **44** : 93–94.

The variety referred to is early, with a vegetation period of 140 days, productive, giving yields of 38–40 quintals of dry grain per hectare in average soils, and has a horny rather than farinaceous grain, being thus rendered resistant to mould. It produces flour of high quality containing 9–12 per cent protein, and has a number of other desirable features, which are described. It has been extensively used by the Reale Stazione di Maiscoltura as a basis for hybridization and has proved highly adequate in this respect.

Further selection has been practised on the variety on lines proposed by Hopkins and only plants on which the cob was borne at a height of under one metre were selected, in order to produce a type of earlier maturity; types with 12 or 14 rows of grains in the cob, with grains of good yellow colour and fine cob rachis and as nearly as possible cylindrical cobs were selected by mass selection, no control of the pollen being effected. In this way a general improvement of the type has been achieved, whilst at the same time reducing the vegetation period to 130 days and the height to 1·80–1·90 m. Seed of the new selection is being widely distributed and has given yields of up to 67 quintals per ha. It has proved adaptable to a wide range of cultural conditions.

650. Johnson, I. J., Doxtator, C. W., 633.15:575.12(77.6)
Hayes, H. K. and 635.67:575.12(77.6)
Crim, R. F. 635.677:575.12(77.6)
Minnesota corn hybrids.
Bull. Minn. Agric. Exp. Sta. 1936 : No. 326 : Pp. 23.

After a brief account of the production of the different types of hybrid maize, descriptions are given of the hybrids distributed by the Minnesota Experiment Station.

The field maize hybrids include two double crosses, Minhybrids 401 and 402, made by crossing a Minnesota 13 single cross, E, with the single crosses, K and I, obtained from Rustler inbred lines. As the Rustler lines have white and the Minnesota 13 yellow endosperm, the double crosses produce a mixture of yellow and white grains; breeding work is in progress to remedy this defect by changing the endosperm of the Rustler lines from white to yellow. The other field maize hybrid is the three-way cross Minhybrid 301 made by crossing the Minnesota single cross E with an inbred line B 164. The regional adaptation of these hybrids, as indicated by their performance in trials, is described.

The sweet corn hybrids distributed are all single crosses, which possess the important advantage for canning purposes of uniformity. Minhybrids 201, 202 and 203 are Golden Bantam types, Minhybrid 204 a Crosby type and Minhybrid 205 an improved Country Gentleman type.

The most desirable pop corn hybrid is the Japanese Hull-less type Minhybrid 250, a single cross. All the hybrids have given greater yields than the corresponding standard varieties and often possess other advantages.

651. Hume, A. N. and Franzke, C. J. 633.15:575.12(78.3)
Hybrid corn.
Bull. S. Dak. Agric. Exp. Sta. 1936 : No. 299 : Pp. 28.

A popular account of the phenomenon of heterosis and practical application in hybrid maize. Data are given on the yields of different hybrids in South Dakota.

652. Kozubenko, V. E. 633.15:575.14
(**Breeding maize by the method of inbreeding**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 26–29.

Special attention is being given to a line of maize with two cobs per plant, isolated by inbreeding and outyielding the one-cobbed forms by up to 50 per cent. By the same method it has

been possible to produce forms with greater disease resistance and much higher standing capacity, certain individuals remarkably free from wilting during drought conditions and others with higher starch content and a number of other desirable features. Gigantism was also observed.

Crosses were made between some of the inbred lines. One of the hybrids was promising on account of its earlier maturity, ripening five days before the better parent and giving 60 per cent greater yield. Another hybrid, giving 50 per cent more yield than the better parent, matured all its cobs simultaneously, a useful character for canning. The work of hybridization is being greatly extended.

653. Rhoades, M. M. 633.15:576.356.2:575.11

A cytogenetic study of a chromosome fragment in maize.

Genetics 1936 : **21** : 491–502.

In the progeny of a plant carrying an extra chromosome V, a plant appeared which in appearance was intermediate between the trisomic and the normal. Cytological examination shewed that it carried a fragment consisting of the entire short arm of chromosome V. The fragment had a completely terminal spindle attachment. Observations at pachytene and metaphase indicated that it paired with the normal fifth chromosomes in about 50 per cent of the cases, forming a trivalent which usually disjoined so that the fragment accompanied one of the normal chromosomes to the pole. When a univalent was present it was always the fragment and it often failed to be included in the interkinetic nuclei. When association at pachytene did occur it was always by pairs at a given level and the spindle attachment region of the fragment was rarely associated with those of the normal chromosomes.

A plant carrying the fragment and homozygous for A_2 was pollinated by a plant homozygous for a_2 and for A_1CR and the F_1 fragment plants were back-crossed with recessive a_2 pollen. An average of 33·6 per cent recessives was thereby obtained and the deviation from the 1 : 1 back-cross ratio shews that a_2 is located in the short arm of the fifth chromosome. By similar methods the genes V_2, *Ys*, *Pr*, V_{12}, V_3 and Bt_2 were located in the long arm and Bm_1 was located in the short arm. The location of Bt_1 and Bm_1, on opposite sides of the spindle attachment is of interest, for these genes shew little crossing over.

From other crosses evidence was obtained indicating that 1 or 2 per cent of the functioning pollen grains from the fragment plant were hyperploid for the fragment chromosome and that crossing over in certain regions was increased in fragment plants as compared with normal diploids.

654. 633.15–1.521.5

Kozubenko, V. E. 633.15:575.183

(It is necessary to make the method of maize certification more accurate).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. **3** : 58–61.

The difficulties of carrying out certification on purely botanical characters are illustrated by reference to certain varieties, e.g. Minnesota 28 and 13, which regularly segregate for core colour. Again, the author's experiments have shewn that in yellow-grained dent varieties, xenia due to pollination with white varieties is of frequent occurrence and the presence of white grains is thus no indication of the hybrid nature of the entire cob. This is not the case in the flint varieties, where yellow is dominant to white. The author's observations fully confirm the dominance of the maternal type of grain as regards consistency, owing to the reduplication of the maternal set of chromosomes. A table is given illustrating the behaviour of the colour and consistency of the grain in hybrids of different parental types.

655. Sokolov, B. and Krečetov, A. 633.15–1.524

(Results of work with the world collection of maize).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 3 : 72–78.

Specimens from every maize-growing country in the world have been examined and the varieties with the earliest maturity have been singled out; also forms suitable for fodder and silage and for starch production. Forms suitable for manufacture of cereals and sweet corns for culinary purposes have also been selected.

656. HARRIS, M. R. 633.15–2.484:581.44:575
The relationship of *Cephalosporium acremonium* to the black-bundle disease of corn.
Phytopathology 1936 : **26** : 965–80.
Evidence is presented to shew that the black bundle disease of maize is determined by hereditary factors in the inbred strain A1237, while in some other strains it could be induced by environmental factors. The association of *C. acremonium* is merely secondary.

BARLEY 633.16

657. KONSTANTINOV, P. N. 633.16:575(47)
(Breeding barley).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 40–47.
Barley is much more productive than any other cereal in arid districts; the existence of varieties resistant to frit fly (and also to smut and other diseases) makes the cultivation of barley all the more desirable.
A number of suitable parents for breeding for a variety of desiderata are mentioned. Some of the varieties selected for frit fly resistance display considerable resistance though none are fully immune; early varieties tend to be more free from attack than later varieties. In selecting for early maturity differences can be most clearly detected at the time of earing.
The merits of various forms as parents are discussed and the characteristics of some of the most promising hybrids described. Three of these gave an average yield of 20·2 centners per ha. as against 15·5 for the standard variety *Medicum* 026; the straw of all was higher, a character of much value for mechanical harvesting, and all possessed a number of other valuable characters including freedom from frit fly and smut, large grain and yield equal or superior to the standard.

658. MIKHAILOVSKII, V. A. 633.16:575"793"(47)
(New varieties of barley from the Tulun Regional Experiment Station).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 1 : 56–58.
Barleys with a vegetation period of not more than 65 days, with high yields and naked grains or thin husk are desired. Good forage and malting barleys are also required. Various promising new varieties are described, namely:—
T 231/II, a six-rowed variety isolated by V. E. Pissarev from the local barley, it matures earlier than any other barley tested, attaining the wax-ripe stage in 60 days; it is six days earlier than the local standard Červonets which it also excels in yield, giving an average of 13·8 centner per ha. over two years' tests as compared with 12·4 for Červonets. It is more resistant to pests and has a lower percentage of husk.
T 283, a six-rowed selection maturing 1–2 days earlier than Červonets, having a vegetation period of 65 days; in yield it is considerably better than Červonets, particularly in dry years and on poor soils; in tests over a number of years it has given an average yield of 15·6 centner per ha. It is more resistant to pests and equal in percentage of husk.
No. 741, a two-rowed naked barley selection, characterized by very high yield and large grain with a thousand corn weight of 53·2 grm. It is somewhat later than the above, with a vegetation period of 74 days, but should be valuable for regions other than the extreme north.
No. 896, a six-rowed barley selection giving yields of up to 25·9 centner per ha., greater therefore than any of the other varieties tested. It has very large grains but its vegetation period is 73 days.

659. NILSSON, F. 633.16:575.3:631.41
Bodenreaktion und Sorten. **(Soil reaction and varieties).**
Züchter 1936 : **8** : 199–201.
Having shewn the importance of environmental adaptation as a factor to be considered in breeding varieties, the author shews that by selection, types can be obtained resistant to certain

soil defects and diseases connected with them. Observations are recorded shewing that in Swedish barleys heritable differences in adaptation to acid soils are found and that such characteristic differences are present even in the natural populations and could be transferred to new varieties by hybridization.

660.

LAUMONT, P. and ERROUX, J. 633.16:[581.4:581.2:575

Observations tératologiques sur l'orge. (**Observations on malformations in barley**).

Bull. Soc. Hist. Nat. Afr. N. 1935 : **26** : 263–68.

Notes on a number of teratological types of structure affecting the stem, ear, spikelet, glumes and flowers in barley—some of which may be hereditary, some not.

661. 633.16-2.42–1.521.6:575(43)

HONECKER, L. 632.42 *Erysiphe graminis*:576.16:633.16

Über den derseitigen Stand und die Aussichten der Bekämpfung des Meltaubefalles der Gerste durch Züchtung. (**On the present position and prospects of combating mildew attack of barley by means of breeding**).

Prakt. Bl. Pflanzenb. 1936 : **13** : 309–20.

In this statement concerning the present position in Germany as regards the need for brewing and fodder barleys that are resistant to mildew (*Erysiphe graminis*) the biology of the fungus, its various racial forms, are discussed, with reference to the varietal reactions and the necessity for altering the test collection previously used (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 369 and Vol. VI, Abst. 556).

In view of various economic factors in the situation in Germany, attention should be concentrated on the breeding of resistant winter barleys, while cultivating resistant spring forms in the meantime.

General references are made to the difficulties that are being encountered in the breeding experiments in progress, which are to be reported in full later. The usual variations in the resistance characters as regards dominance and segregation according to single or multiple factor differences have been noted. The combination of resistance with good economic properties is, of course, the ultimate aim.

662. BAKHTEEV, F. KH., BYKOVETS, A. G. and ČEČETKINA, A. N. 633.16–2.7–1.521.6

(**Barleys resistant to frit fly**).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 4 : 85–86.

Observations on 3,563 forms of barley in the world collection shewed that only twenty of these can be recommended for use as parents in breeding for resistance to frit fly. A list of these varieties and of their main characteristics is given.

MILLETS AND SORGHUMS 633.17

663. 633.174:575(47)

*VENGRENOVSKII, S. I. 633.174:575.127.2

(**Results of breeding sorghum and interspecific hybridization**).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 3/11 : 28–34.

Observations have been made on a collection of sorghums from all over the world consisting of 300–400 different specimens. The desirable agronomic characters are found scattered over these different varieties and never occur united in a single variety or form. This is illustrated with respect to sweet, fodder and grain sorghums.

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* An extended summary of this paper is on file at the Bureau.

By selection an ultra-early variety of kaoliang has been produced and is being used for crossing. Forms exceeding the earlier parent by as much as 15 days in earliness have also been obtained by application of the principle of phasic development in hybridization.
The inheritance of a number of important economic characters was studied in various crosses. Crosses have also been made between Sudan grass and sorghum and segregates have been obtained which in vigour and luxuriance, and hence yield of green matter per acre, surpass any known forms of either sorghum or Sudan grass.

664. VINALL, H. N., STEPHENS, J. C. and MARTIN, J. H. 633.174:575(73)
Identification, history and distribution of common sorghum varieties.
Tech. Bull. U.S. Dep. Agric. 1936 : No. 506 : Pp. 102.
After a survey of the previous literature on the classification of *Sorghum* and some general observations on botanical relationships, external morphology and development and on the methods of studying varieties, the characters used to describe varieties are enumerated and enlarged upon. There follows a dichotomous key to the varieties grown in the U.S.A. and the remainder of the bulletin, some 60 pages, is devoted to a descriptive list of the varieties, illustrated by photographs of the panicles and individual grains. The history, distribution and synonyms of each variety are given.

665. 633.174:576.312.35
MORIYA, A. 633.174:576.356.5
(**Chromosome studies in Manchurian Kaoliangs**).
Jap. J. Genet. 1936 : **12** : 146–50.
The chromosome number n = 10 or 2n = 20 was established for 61 varieties and strains of Manchurian kaoliangs investigated. No polyploidy was observed and, in general, meiosis was normal.
In all the somatic chromosomes a median or submedian attachment constriction was observed. The A chromosomes recorded by Huskins and Smith (Cf. "Plant Breeding Abstracts", Vol. II, Abst. 536) were found in root tips of certain agricultural varieties.

666. WAGNER, F. A. 633.174–2.411.4–1.521.6:575.42
Reaction of sorghums to the root, crown, and shoot rot of milo.
J. Amer. Soc. Agron. 1936 : **28** : 643–54.
The reaction of a large number of varieties and strains of sorghum to milo disease has been tested. The disease is due primarily to *Pythium arrhenomanes* Drechs. Milo and most milo derivatives proved very susceptible, as did also the variety Darso. Kafirs, feteritas and most sorgos are highly resistant.
Resistant strains have been derived by selection from the milo varieties Dwarf Yellow, Beaver and Wheatland and similar work is proceeding on Day milo.

RICE 633.18

667. BURKILL, I. H. 633.18(91)
Culture et usages du riz en Malaisie. (**Cultivation and uses of rice in Malaya**).
Rev. Bot. Appl. 1936 : **16** : 130–38, 223–30, 301–07, 382–85.
Treats of the work already reviewed in "Plant Breeding Abstracts", Vol. VI, p. 325, with special reference to the section on rice.

668. TANG, W. T. 633.18:575.11–181.12:581.46
(**A study on the mode of inheritance of the length of spikelet in rice**).
J. Agric. Res., Nat. Cent. Univ., Nanking 1935 : **2** : 127–36.
Crosses, done in the glasshouse, with Anhui shantas (mean spikelet length 12·985 mm.) and Shensi shantas (mean spikelet length 8·265 mm.) give an F_1 of mean spikelet length 9·7184 mm. with coefficient of variation 3·9071, very near to the coefficient of the parents. The second generation F_2 has mean spikelet length 9·8219 but with coefficient of variation increased to 7·6686, shewing segregation. For the third generation groups of mean spikelet lengths 8·25,

8·75, 9·25, 9·75, 10·25, 10·75, 11·25, 11·75, 12·25 from F_1 (those with Anhui shantas ♂ and Shensi shantas ♀) were taken for crossing. Some of the resulting families still shew segregation. There are, here, significant differences in spikelet length between each family with either of the two parents. The author concludes that the two parental stocks differ in a series of factors for dominance. Each spikelet length used is the mean of six micrometer measurements taken at random on six different spikelets of an ear. P. C. T.

669. KADAM, B. S. 633.18:575.113.6.061.6
An anthocyanin inhibitor in rice.
J. Hered. 1936 : **27** : 405–08.

The variety Nagkeshar is characterized by dark purple pigmentation over all the vegetative parts of the plant, while the variety Ratanghose is entirely green. The F_1 hybrid between them had coloured leaf sheaths but green leaf blades. In F_2 there occurred 9 red-stemmed green leaved: 3 purple: 4 entirely green plants. This and the further segregations observed in F_3 and F_4 indicated that the general anthocyanin pigmentation was due to a single dominant gene *A*, while a dominant inhibitor *I* suppresses anthocyanin colour in the leaf blade though allowing its development in other parts.

670. CHAO, L. F. 633.18:575.116.1
(Linkage studies of rice).
J. Agric. Res., Nat. Cent. Univ., Nanking 1934 : **1** : 13–63.

In continuation of research begun in 1924 linkage relations of a large number of varieties were studied in the F_2. The gene pairs for awned and awnless An_1 an_1 An_2 an_2 were found to be independent of *Gl gl*, the factor pair for the gluten character.

At the emergence of the spike the awn was green, changing later to yellowish brown, the latter condition being probably a simple dominant to that of green awn. A ratio of 309 coloured awn, non-glutinous plants: 43 colourless (i.e. green) awn, non-glutinous: 30 coloured glutinous: 58 colourless glutinous was obtained in this cross.

The gene for red husk Pr_1 and the *Gl* were independent and Pr_1 was dominant to white husk. Purple husk was, however, conditioned by duplicate factors Pr_1 and Pr_2.

Length of glume is conditioned by two genes G_1g_1 and G_2g_2, long glume being recessive in F_1. Glume length is independent of the gluten and grain husk characters.

A study of short and long spikelet types shewed that the gene for short spikelet was closely linked with that for short glume; while the anthocyanin gene conditioning coloured stigma was closely linked with *Gl* and with apical colour of the chaff, which is linked with at least four genes, including that for leaf sheath colour.

Colour of the leaf ligule is independent of *Gl* but closely linked with grain husk colour.

Chaff colour, which is probably controlled by two pairs of complementary factors, is independent of the colour of the node and of the leaf sheath.

The three or four definite linkage groups observed are enumerated with data on the cross-over values (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 1050). W. T. C.

671. HARAJIMA, S. 633.18–1.547.25:581.4:575
(Comparative studies in lowland and upland varieties of rice plant in regard to the morphology of their seedlings).
Proc. Crop Sci. Soc. Japan 1936 : **8** : 192–210.

Morphological differences in the two types of variety are recorded in the structure of the leaf sheaths and of the seminal roots, form of the second leaf and position of the first tiller.

672. CRALLEY, E. M. 633.18–2.42–1.521.6:575
Resistance of rice varieties to stem rot.
Bull. Ark. Agric. Exp. Sta. 1936 : No. 329 : Pp. 31.

Tests of 125 varieties indicate that in general the short-grained varieties are less susceptible to *Leptosphaeria salvinii* Catt. than the medium and long-grained varieties, which are more extensively grown. Results, as yet incomplete, from tests of hybrids between the two types, suggest that it may be possible to produce resistant long grain types by hybridization.

LEGUMINOUS FORAGE PLANTS 633.3

673. 633.367:581.192.6:575
FEDOTOV, V. S. 633.367:575.127.2
(Breeding alkaloid-free lupin for groups of agronomic characters).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 27–31.

Having attained the necessary low alkaloid content, it now remains to produce types of sweet lupin free from shedding, resistant to *Fusarium* and with thin seed coat for culinary purposes, and also to raise the oil content still further in the high oil-containing forms recently discovered.

Experience with the selection of the alkaloid-free forms has shewn that selection for new characters is useless unless it is carried out on such an extensive scale as to make possible the inclusion of the entire range of variation in the initial material. Hundreds of thousands of plants must often be examined in respect of each character before the desired forms are discovered.

By selection the maturity of the alkaloid-free forms of *L. angustifolius* has been accelerated and by hybridization white seeded perfectly sweet forms of *L. luteus* have been obtained, having a protein content of 48 per cent in the seeds; these are promising for culinary as well as for forage purposes.

As regards interspecific hybridization the greatest success is expected from crosses between *L. angustifolius* and *L. pilosus*, which have the same chromosome number $2n = 40$. For *L. albus* ($2n = 48$) the most suitable parent is thought to be *L. mutabilis*, which is a species with a wide range of forms. The species has been crossed successfully with *L. pubescens*, *L. varius* and *L. venustus*, all of which also have 48 chromosomes. From the cross with *L. pubescens* it has been possible to isolate forms with a very high oil content considerably earlier in maturity than the *L. mutabilis* parent.

In connexion with the production of non-shedding forms it has been found that thinness of the sclerenchyma (parchment layer) is associated with a lower tendency to dehiscence in the pods.

Some varieties of lupin have been shewn to react more than others to vernalization and by application of Lysenko's theory it should be possible to produce exceptionally early maturing forms.

674. ZIMMERMANN, K. 633.367:581.47
Die Züchtung von Lupinen mit nichtplatzenden Hülsen. I. Anatomie und Morphologie der Lupinenhülsen. **(The breeding of lupins with non-splitting pods. I. Anatomy and morphology of lupin pods).**
Züchter 1936 : **8** : 231–40.

The anatomical and morphological structure of the pods of the splitting types, *Lupinus luteus* and *L. angustifolius* is examined in detail and compared with that of the non-splitting types *L. albus* and *L. mutabilis* and with three other non-splitting leguminous plants, *Glycine hispida*, *Pisum sativum* and *Phaseolus vulgaris*. The results shew that the mechanical strength lies in the fibrous layer and this also is the tension-producing factor. The greatness of the mechanical strength is dependent on the thickness and structure of the fibrous layer, and on the breadth and length of the pod.

Other factors such as the strength of the suture and the strength of attachment of the pedicel, act as inhibitors of splitting if the mechanical strength is not too great and the balance between these forces produces the various degrees of splitting found in the pods of the different lupin species.

ROOTS AND TUBERS 633.4

675. OLSSON, P. A. 633.4:575(43)
Über die Methodik der Rübenzüchtung. **(On the methods of breeding root crops).**
Züchter 1936 : **8** : 208–11.

Some notes on past and recent work done at Svalöf on sugar beet, mangel, swede, turnip and carrot breeding. The mangels displayed a much higher degree of self-fertility than the beets

or the turnips, while the carrots approximate in this respect to the beets. Degeneration following inbreeding, though not so marked in the mangels as in the other root crops (e.g. beets and turnips), is always present in some degree; and even the well-known inbred Weisser Eckendorfer strain, which is so valuable for breeding work, is not equal to the commercial varieties in yield. In the experiments on breeding "hybrid strains" (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 917) by crossing inbred or commercial varieties in order to make use of heterosis, mangels gave much less favourable results than beets or turnips, though results have been obtained in connexion with other work (Cf. "Plant Breeding Abstracts", Vol. II, Abst. 644), shewing that heterosis may occur in mangels and suggesting that "hybrid strains" of practical value may be produced in the future.

676. Bonne, C. 633.41–1.557:575.14
Untersuchungen zur Ertragsfähigkeit der Zuckerrübe dargestellt an Standweiten- und Inzuchtversuchen. (**Investigations on the yield capacity of sugar beet as exhibited in spacing and inbreeding experiments**).
Z. Ver. dtsch. Zuckerindustr. 1933 : **83** : 357–75.

Experiments were made to obtain an increase in yield by reducing the variability of the strains. Two strains with high and low weight of roots isolated from 1922 shewed no decrease in the variability as compared with the free flowering controls.

Further isolation experiments shewed that after five years' isolation there was always a marked occurrence of colour variants with an increase in yield capacity. The ratio of white to coloured variants in the progeny from a red mother beet was approximately 1 : 2 and that from a yellow mother beet 1 : 1. The white variants were true sugar beets with regard to sugar content and the possibility of obtaining homozygous strains with an increased yield capacity by this method is suggested. Colour variants do not therefore necessarily indicate any recent hybridization with forage beet.

677. 633.491:575:061.3(73)
Report of the Western States Conference of potato breeders and pathologists in Iowa, Minnesota and North Dakota. Aug. 24-29 incl., 1936.
Amer. Potato J. 1936 : **13** : 259–61.

The topics mentioned in the report include the value of co-operation between pathologists and breeders, the progress made in developing tests of resistance to different diseases, the wide variety of aims in potato breeding in different states and the production of lines for breeding of known genotypic qualities.

678. Veselovskii, I. A. and
Veselovskaja, M. N. 633.491:575.127.2:575"793"
(**The question of breeding the potato for earliness**).
Selektsija i Semenovodstvo (Breeding and Seed Growing 1935 : No. 3/11 : 47–49.

By the use of the earliest varieties known it is possible to get quite good yields of potatoes in the arctic territory of the U.S.S.R. Some hybrids between these early varieties have proved still earlier but most of them are inferior in yield. The best results were obtained from crosses between the early varieties and mid-early or mid-late forms. From such a cross of Cobbler x Kn. Korona and Epicure x Alma useful early forms with high yields have been obtained.

Among the new South American species, *S. Rybinii*, though apparently unsuitable as a parent for breeding early maturing forms on account of its late tuber formation, is useful because of the entire absence of dormancy of its tubers. Hybrids of it with certain varieties of *S. tuberosum* contain a high proportion of early forms, e.g. with Epicure. Another very promising combination is the hybrid *S. goniocalyx* x *S. Rybinii* x *S. phureja*. The great advantage of

the hybrid *S. Rybinii* x *S. phureja* is that it produces large quantities of fertile seeds and is, therefore, useful in further breeding.
The hybrid *S. ajanhuiri* x *S. phureja* is also very early and at the same time resistant to 2–4° C. of frost. Fertile early forms have also been obtained from the combination Jubel x *S. phureja*. From the results there is no doubt that these species without dormancy constitute a new and highly promising line in breeding early potatoes. Various other interesting combinations are enumerated. Triple hybrids shewed a definite tendency to be more productive than ordinary double hybrids, which at Khibiny gave yields of 0 300 grm. per plant as compared with 300–1,000 grm. in the triple hybrids. This phenomenon is ascribed to polymery.

679. 633.491:575.7
DIEHL, R. 633.491.00.14
Les problèmes actuels de l'amélioration et des champs d'expériences de pommes de terre. (Comportement des variétés à l'égard des maladies de dégénérescence). [**Present day problems of potato improvement and field trials. (Behaviour of the varieties in regard to degeneration diseases)**].
Sélectionneur 1936 : **5** : 81–89.
Some general comments on some of the problems connected with degeneration. Groups of varietal types of behaviour are considered with lists of the varieties belonging to each group; the importance of environmental adaptation, and the effects of diseases as factors affecting degeneration phenomena and complicating their study are indicated.

680. COSTANTIN, J. 633.491:581.143.26:575.31
La variété Dauzère, mutation de la pomme de terre de Roquelaure (Gers). [**The variety Dauzère, a mutation of the potato of Roquelaure (Gers)**].
C.R. Acad. Sci. Paris 1935 : **201** : 1447–49.
This "variety" which was found in a vineyard at Roquelaure and which reproduced itself each year by means of its tubers is discussed from the point of view of the inheritance of acquired characters. In this case the assumed possession of symbiotic fungi is held to account for the perennial habit.

681. 633.491:581.162
VESELOVSKII, I. A. 633.491:575.127.2
(Extending potato cultivation by means of seeds).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 33–35.
The value of using seeds rather than tubers when planting material has to be conveyed through unfavourable conditions is emphasized. In many cases the yield obtained from seeds has greatly exceeded that from tubers.
It is further pointed out that very much higher yields are obtained from triple hybrids obtained by back-crossing hybrids of *S. andigenum* than from seedlings of the domestic potato.
Hybrids with the forms from the high plateaux of South America are being used for the extreme north of the Soviet Union.

682. BUTLER, O. 633.491:581.165:575.22
Variations in yield of pure line Green Mountain potatoes grown in a controlled environment.
J. Amer. Soc. Agron. 1936 : **28** : 706–10.
Ten tubers of the Green Mountain variety were selected and plants grown from them under two different average temperatures. The lines were continued for several vegetative generations and data on yield were taken.
The conclusion was reached that selection of seed potatoes from healthy stock on a basis of yield and tuber number is a waste of time.

683. Schwartz, A. and Kuzmin, S. F. 633.491:581.192.2:575.11

A study of the potato in genetic aspect II. Variability of protein content in the *S. phureja* x *S. Rybinii* interspecific hybrids.

C.R. (Doklady) Acad. Sci. U.R.S.S. 1936 : **3** (XII) : 181–84.

Five plants were taken of each of the F_1 hybrids referred to in the earlier work (see "Plant Breeding Abstracts", Vol. VI, Abst. 1283) and the tubers were analysed. The protein content varied from 8·53 per cent. in the lowest to 15·68 per cent in the highest hybrid, the average for the common domestic variety, Jubel, being 5·41 per cent. The variation is evidently due to the heterozygosity of the parent forms and shews the heritable nature of the protein content. An increase in the amount of protein relative to carbohydrate occurred during storage, due evidently to the loss of the latter by respiration.

684. 633.491–1.524.4(8)

Bukasov, S. M. 633.491:575.127.2(47)

The problems of potato breeding.

Amer. Potato J. 1936 : **13** : 235–52.

Further experience with the South American potato species has shewn that although under certain conditions *S. andigenum* has been low in yield, in some districts, e.g. Pamir, it has outyielded all others, including the best commercial varieties; 7½ lbs. of tubers per plant, for instance, have been obtained from it in Pamir. *S. andigenum* has a longer period of dormancy than the domestic potato, certain others have no rest period and produce two crops a year regularly in South America. Some other wild species, e.g. *S. Commersonii, S. Vavilovii,* have an extremely long rest period; they require a higher temperature for sprouting. Some of the wild species such as *S. acaule, S. demissum,* etc. also require an unusually high temperature for the germination of the seeds, all of which points to the tropical or subtropical origin of the primitive potatoes.

In the majority of species flowering is depressed by short day, though some are unaffected in their flowering by the length of day.

Frost resistance is found, in addition to the mountain species *S. acaule, S. Juzepczukii, S. ajanhuiri* and *S. curtilobum,* also in certain subtropical species *S. Millanii* and *S. Commersonii.*

A considerable degree of drought resistance has been observed in some of the species, e.g. *S. mammilliferum, S. curtilobum, S. ajanhuiri* and *S. loptostigma,* although the last-named is morphologically hardly to be distinguished from *S. tuberosum.*

Reference is made to the work of Schmidt, Salaman and others on the production of blight-resistant forms by hybridization with *S. demissum,* and to observations of Rokhlina who found the content of solanin in the shoots to be proportional to the blight resistance in a number of different species and varieties. Many of the forms of *S. andigenum* and some other species are resistant to wart, and *S. andigenum* and *S. Bukasovii* are more resistant to scab than the commercial domestic potatoes.

Differences between the species have been established in respect of content of vitamin C, gluten, nitrogen, starch, solanin, and oxidase and in buffer index.

The most promising lines of breeding are thought to be crossing *S. andigenum* with *S. tuberosum* and back-crossing the F_1 or selected F_2 hybrids to the domestic potato; similarly in using the other species, the amount of back-crossing necessary rising with the primitiveness of the species used. So far no promising hybrids have been produced from the diploid and triploid species, with the exception of *S. Rybinii.* The yield of the best *S. demissum* hybrids is about half that of the domestic variety participating. Much higher yields have been obtained, however, from triple hybrids such as Kovalenko's Epicure x *demissum* x *andigenum* (Caiceda), Epicure x *demissum* x Katahdin, back-crosses of *S. Antipoviczii,* etc. The third back-cross may be equal to the best domestic potato in yield. Very promising yields have been obtained from hybrids of *S. Rybinii* and *S. phureja,* many of which have recalled the domestic parent and second back-cross hybrids of *S. curtilobum* have also exceeded the domestic parent. The greatest excess over the domestic parents has been observed in the hybrids of *S. andigenum* and some of these have given an excess of 200 per cent over the standard domestic varieties. Various species and forms distinguished by a high starch content are enumerated and it is shewn that even in other quality factors there is no obstacle to the use of the native species in breeding high quality domestic forms.

685. Sidorov, F. F. 633.491–1.524.4:575.127.2
(Rejuvenation of the potato).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 4 : 45–46.
Twenty new cultivated species of potatoes have now been established, together with 30 wild species. No less than nine Mexican wild species are immune or highly resistant to blight both in the haulm and in the tuber. Ten frost-resistant species have been found, including both cultivated and wild forms. Two species, *S. Rybinii* and *S. boyacense*, are free from dormancy and *S. phureja* is characterized by an uncommonly high protein content, more than double that of the domestic varieties. *S. neo-Antipoviczii* is distinguished by high vitamin C content, three times that of the domestic varieties and approaching the amount found in black currants and other fruits. Wart resistance, early maturity and other desirable characters have also been found in these potatoes.
By hybridization with *S. demissum* high-yielding forms resistant both to blight and frost have been produced and promising hybrids have been obtained also from *S. Antipoviczii* and other species, including a blight-resistant hybrid from *S. acaule* x Fürstenkrone, both susceptible. Frost-resistant hybrids have been produced from a number of different wild and cultivated species.

686. Stevenson, F. J. et al. 633.491–2.411.4–1.521.6:575(73)
Breeding for resistance to late blight in the potato.
Amer. Potato J. 1936 : **13** : 205–18.
A brief account is given of previous work on breeding blight resistant potatoes.
Work is now being done by the United States Department of Agriculture, in co-operation with the University of Maine at Presque Isle, Maine and with the University of Maryland at Beltsville and Oakland, Maryland, in an attempt to see what progress can be made with varieties and strains of *Solanum tuberosum* without the use of species hybrids.
Both natural and artificial epidemics of *Phytophthora infestans* have been employed in testing for resistance and it has been found that provided a heavy epidemic is induced the results of one year's test seem quite reliable. A considerable proportion of susceptible progeny can be eliminated in the single plant stage.
The resistant varieties used have included No Blight, Askersegen, Ekishirazu and progenies related to Müllers W-races, the susceptible varieties including Katahdin, Chippewa and Green Mountain. The reactions of different progenies obtained are tabulated. Resistant plants have been obtained by selfing a susceptible variety, by crossing two resistant varieties, by crossing a resistant variety with a susceptible one and by crossing two susceptible varieties. A resistant selection from Chippewa x Katahdin is very promising in respect of yield.

687. 633.491–2.412.5–1.521.6:575(44)
Ducomet, V. and Diehl, R. 633.491–2.412–1.524.2(8)
La galle verruqueuse de la pomme de terre. (*Synchytrium endobioticum* [Schilb] Perc.). Mise au point de la question de la résistance des variétés.
[**Wart disease of the potato.** (***S. endobioticum*** [**Schilb**] Perc.) **Review of the question of the resistance of varieties**].
Ann. Épiphyt. Phytogénét. (1934/35) : 1936 : **1** : (N.S.) : 57–79.
The introduction of wart disease into different parts of the world is briefly traced.
A list of susceptible and resistant varieties, including 284 varieties, is given, based on results obtained at Russ-Hersbach. A study of these results leads to the following conclusions in connexion with the breeding of new varieties in France; resistance to wart disease should be considered of primary importance, and should be combined, when possible, with resistance to mildew; new, productive, early and semi-early varieties with yellow flesh are needed to replace Eerstelingen and Bintje; late and semi-late varieties with red skins and yellow skins, yellow flesh, of good quality and keeping well should be produced in industrial potatoes, varieties with a starch content of at least 20 per cent and with very heavy yields should be sought. A list is given of varieties which on account of their sexual fertility could be used in breeding for these objectives.

Little is known of the nature of varietal resistance but it is pointed out that different degrees of resistance occur. Most resistant varieties selfed give a proportion of susceptibles, and, though the present authors have no conclusive evidence on the point other workers report that certain susceptible varieties on selfing can produce some resistant plants.
The results obtained from some progenies from selfings and crossings are given and different hypotheses of the genetical basis of resistance are discussed. Black's (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 568) is considered to agree most closely with the observed facts. The need for larger progenies before the question can be finally settled is indicated.
A list of other Solanaceous hosts of *Synchytrium endobioticum* is given, including those of the South American *Solanum* species collected by the Russian expeditions (Cf. The South American Potatoes and Their Breeding Value*) which have been found susceptible at Russ-Hersbach. Susceptible forms were found in all the five chromosome groups, diploid (2n = 24), triploid, tetraploid, pentaploid and hexaploid.

688. Clark, C. F., Raleigh, W. P. and Stevenson, F. J. 633.491–2.412.5–1.521.6:575(74.1)
Breeding for resistance to common scab in the potato.
Amer. Potato J. 1936 : **13** : 256–59.

Breeding for resistance to scab was begun by the United States Department of Agriculture in 1930, co-operating with the Maine Agricultural Experiment Station. The resistance of a number of potato varieties has been tested and a considerable degree of resistance found in several, including some imported from Europe on account of the resistance they had shewn there. A collection of ninety varieties from Chile was also tested; thirty-two of them shewed varying degrees of freedom from the disease but many of them produced only small tubers and it is doubtful whether reliable readings are always obtained from small tubers.
All the 392 seedlings from a cross between the two susceptible varieties Columbia Russet and Katahdin were white-skinned and susceptible.
Seedling No. 44537 was the only russet-skinned seedling in a progeny of about 2,250 obtained from a cross between two white-skinned susceptible varieties, Chippewa and Katahdin. It shews some resistance to scab and progenies have been produced from it by inbreeding and by crosses with Mahr's Russets, Katahdin and No. 45075. In each of these four progenies both white and russet resistant seedlings were obtained.
None of the seedlings or important varieties so far obtained is promising from a commercial standpoint but several are believed to be valuable for further breeding work.

689. Köhler, E. 633.491–2.8:578.081
Der Virusnachweis an Kartoffeln. Eine Anleitung für Züchter und Kartoffelbegutachter. **(Demonstration of the presence of virus in potatoes. A guide for potato breeders and judges).**
Mitt. Biol. Reichsanst. Berl. 1936 : No. 53 : Pp. 9.

A description of the most important methods used in demonstrating the presence of virus in potatoes, accompanied by descriptions of the phenomena typical of various virus diseases of the potato. The numerous plates that have been included shewing the characteristic effects of infection by the different viruses form an important adjunct to this useful publication.

690. Raleigh, W. P. 633.491–2.8–1.521.6:631.541
An abnormal graft reaction in potato resulting from a virus infection of a scion on a resistant stock.
Phytopathology 1936 : **26** : p. 795. (Abst.)

Scions of the variety Green Mountain or Green Mountain seedlings, infected with latent mosaic (X-virus) developed aerial tubers, rolling of the leaves and marked stunting when grafted on the resistant U.S.D.A. seedling No. 41956, whether the infection took place before or after the

* Issued by this Bureau.

graft. A similar reaction has been observed in scions infected with wild mosaic and grafted on Irish Cobbler, a variety which is somewhat resistant to mild mosaic.
It is suggested that such experiments may be of value in studies on resistance to viruses in potatoes.

691. Solpico, F. O. 633.492:581.165:575.252
A study of variability in clonal progeny of the sweet potato.
Philipp. Agric. 1936 : **25** : 284–94.
An account of a search for bud variations in four local varieties, Inube, Minaynila, Nilabanos and Red variety, vegetatively propagated by different means, namely vine cuttings, terminal shoot cuttings, root cuttings and leaf cuttings.
In plants of all four varieties, propagated by vine cuttings, variants differing in leaf form occurred. In the variety Inube, variants in respect of the pigmentations of the flesh of the roots also occurred, again in the plants from vine cuttings.
Apart from these major variants, the variability did not differ significantly among the clones propagated by different methods.

FIBRES 633.5

692. 633.51(51)
*Grumm-Gržimailo, A. G. 633.51–1.524.4:575
(Cotton growing in China).
Lenin Acad. Agric. Sci., Inst. Pl. Ind., Leningrad 1936 : Pp. 80.
The author concludes that cotton has penetrated into China in comparatively recent times, only becoming general in the thirteenth and fourteenth centuries. It entered from two distinct sources, from south-western Asia (*Gossypium herbaceum* L.) and from Indo-China (*G. arboreum* L.). The cottons of the latter species were perennials and several centuries elapsed before annual forms suitable for growing in the north were evolved.
In China proper the majority of cottons belong to a peculiar endemic group *G. arboreum* L. var. *Nanking* (Meyen) Harl. Variation occurs in respect of all the main morphological and agronomic features. Many characteristic local races have evolved and forms with naked seeds and also forms without petal spot are very frequent.
Similarly in Sin-Kiang the species *G. herbaceum* is predominant and is represented by a group of peculiar local forms quite different from those of Turkey, Iran and other countries. They are extremely early, having a vegetation period of 95 to 122 days in Central Asia. They are also very drought-resistant and though they are susceptible to gummosis (*Bacterium malvacearum*) and wilt they are being used for hybridization.
Upland varieties are also present now.
An outline is given of the work of cotton breeding in China based on the published literature, reference being made to the production of the variety Million Dollar.
Grown at Tashkent this variety is mid-early but the period from flower bud formation to flowering is unusually short, so that it will make a valuable parent for breeding early cottons. Valuable hybrids of it with Indian cottons resistant to cyrtosis have been obtained in China.

693. Jenkins, W. H. 633.51:575(72.95)
Sea-Island cotton in Puerto Rico and its relation to production in the continental United States.
Agric. Notes P. Rico Agric. Exp. Sta. U.S. Dep. Agric. 1936 : No. 71 : Pp. 9.
Attempts are being made to re-establish the Sea Island cotton industry in Puerto Rico. The Insular Department of Agriculture has selected two uniform, high-quality strains, one having a staple length of $1\frac{3}{4}$–$1\frac{7}{8}$ ins. and a lint percentage of 29, the other a staple of $2\frac{1}{8}$ ins. or longer and a lint percentage of 26.
Further possibilities in breeding are mentioned. The development of an early, quick-fruiting type with a determinate habit of growth would be of assistance in the control of pink boll worm.

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* An extended summary of this paper is on file at the Bureau.

It is also suggested that Puerto Rico might co-operate with the United States in the hybridization of long-staple strains of Sea Island and Upland cottons, with the object of developing a type resistant to the boll weevil with the fibre characteristics of Sea Island cotton. This work might be accelerated by growing a crop during the off-season in Puerto Rico and sending the seed to the United States. The Sea Island-Upland type, if developed, might be of use both to the U.S.A. and to Puerto Rico.

694. ONODERA, J. 633.51:575.116.1
(Studies in the correlation among the characters of Asian cotton varieties and their F_2 hybrids).
Proc. Crop Sci. Soc. Japan 1936 : **8** : 151–67.

Varieties from Japan proper, Korea, Manchuria, China and India and their F_2 hybrids were used in this study which shewed flowering time to be markedly correlated with other characters and to be important in the selection of early maturing varieties; it should, therefore, be investigated as well as the time of dehiscence of the bolls.
The lint index appeared to be more significant as a factor determining ginning out-turn in the Asiatic cottons than in the American or Egyptian forms.
Early maturing varieties are distinguished by early flowering, light capsules, a high percentage of burst capsules and light small seed.
By correlation studies in the F_2 linkage was revealed between flowering time, lint index, plant height, length of internodes, of halo and of the largest sympodial branch.
A more fundamental study of the true correlations with the elimination of interference was recognized as essential.

695. SZYMANEK, J.-F. 633.51:575.127.2
Croisement interspécifique des cotonniers. Note complémentaire. **(Interspecific crosses in cotton. Further note).**
Cot. et Cult. Cotonn. 1936 : **10** : 59–77.

The F_1 hybrids of *G. hirsutum* x *G. herbaceum-indicum* and of *G. vitifolium* x *G. herbaceum-indicum* resembled at first sight the maternal parent (*G. herbaceum*) in morphological characters, though a detailed examination shewed traces of the influence of the male parent in a tendency towards a reduction in the number of lobes of the leaf, in relation between length and breadth of the leaf in the first cross and in the depth of lobing and size of fruit in the other. The yield and the quality of the fibre of both these hybrids surpassed those of either parent. The F_1 hybrids of *G. hirsutum* x *G. punctatum* and of *G. vitifolium* x *G. punctatum* were intermediate in character. The progeny of the first cross shewed valuable economic characters; that of the second has fibre of mediocre quality but this was improved in the reciprocal cross.

696. FENG, C. F. 633.51:575.127.2:576.312
(A genetic and cytological study of species hybrids of Asiatic and American cottons).
J. Agric. Res., Nat. Cent. Univ., Nanking 1934 : **1** : 77–107.

During 1931–32, using the Asiatic cottons *Gossypium arboreum* and *G. Nanking* and the American species *G. barbadense* and *G. hirsutum*, eight combinations were made, 1,708 flowers in all being pollinated. The sets obtained were very low and in some cases the cross failed completely. All hybrid bolls were relatively very much smaller and contained very few seeds, which in turn had very small embryos, resulting in poor germination; 22 out of 29 failed to germinate.
The percentage of sterility was much higher when the Asiatic type was used as the ♀ parent.
Tests shewed that failure to set seed was due not to any delay in pollen tube growth but to incompatibility of the gametes.
The hybrid vigour noted in F_1 was especially marked in Asiatic ♀ x American ♂ as compared with the reciprocal.
The inheritance of a large number of characters such as pubescence of leaf and stem, presence

of glands, serration of sepals, petal colour, number of locks per boll, pollen colour, width of leaf blades, was studied as regards dominance.
The F_1 hybrids all shewed a high degree of self- and back-cross sterility, pollen and embryo abortion being possible causes of this defect. The three hybrid F_1 plants examined were triploid and the cross section of the nucleus was larger than in either parent. Many irregularities in the first and second division were noted during gametogenesis in F_1 and defective pairing led to the formation of pollen mother cells with four or more micronuclei.
The author concludes that it is almost impossible to obtain fertile hybrids from such interspecific crosses.
W. T. C.

697. 633.51:575.127.2:576.354.46
WEBBER, J. M. 633.51:575.127.5
Cytogenetic notes on cotton and cotton relatives. II.
Science 1936 : **84** : p. 378.
A report on the pairing observed at meiosis in F_1 hybrids involving cultivated American species, cultivated Asiatic species, wild American species, a wild Asiatic species *Gossypium Stocksii* M. Mast, a wild African species *G. anomalum* Wawra and Peyr., a wild Australian species *G. Sturtii* F. v. M. and *Thurberia thespesioides* A. Gray, a wild American relative of *Gossypium*.
The cultivated American species have 26 haploid and the rest 13 haploid chromosomes.
In hybrids between cultivated Asiatic species and *G. anomalum* and between wild American species and *T. thespesioides* 13 bivalents were observed; $13_{II} + 13_I$ were found in hybrids of cultivated American species with *T. thespesioides* and with *G. anomalum*; 0_{II} to $8_{II} + 10_I$ to 26_I were found in hybrids of cultivated Asiatic species with *G. Stocksii*, while in hybrids between cultivated Asiatic species and *T. thespesioides* 26_I occurred.
Comparison of the results obtained in crosses of wild American and cultivated Asiatic cottons with *T. thespesioides* indicates that the complements of wild American and cultivated Asiatic species are non-homologous, supporting Skovsted's contention that the cultivated American species arose from a cross between types related to these forms. The occurrence of 13 bivalents in the hybrids of *T. thespesioides* with wild American species supports the view that *T. thespesioides* is congeneric with *Gossypium*.

698. WAELKENS, M. 633.51:575.42(44)
Travaux de sélection du coton. (**Work on cotton selection**).
Publ. Inst. Agron. Congo Belge 1936 : Sér. Tec. No. 5 : Pp. 107.
The value of three methods for measuring the fibre is considered, namely the single fibre method, the halo or Bailey method and the method of individual readings. Of these the last is preferred as being more exact.
Mass selection has been abandoned at the Bambesa Station in favour of pedigree selection. There has been a steady increase in length and regularity of fibre. Two families, 145 and 270 are in process of multiplication. The first is especially commended for earliness, yield and fibre of about an inch, but the halo is rather irregular. The second, though not so early, has a very regular fibre but shorter than that of the first family; the yield is equally good.
The hybrids from the crosses Triumph x Columbia, Triumph x Durango and Triumph x Acala are in the F_2. The progeny of the last cross is the most satisfactory.

699. 633.51:576.312.34
ARUTJUNOVA, L. G. 633.51:576.16:575.127.2
An investigation of chromosome morphology in the genus *Gossypium*.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1936 : III (XII) : 37–40.
Use was made of various new fixatives elaborated by Levitsky for the detection of chromosome morphology and giving better results than his original "weak chromic formalin". The species studied were *G. herbaceum* (2n = 26) and *G. hirsutum* (2n = 52). The platinic formalin solution proved the most successful. In *G. herbaceum* thirteen chromosome types were

established, seven of which shewed secondary differentiations. About one-third of the chromosomes are much smaller than the others. In *G. hirsutum* each type appeared to be present twice, suggesting that the species is of autopolyploid origin, and not an amphidiploid as stated by Skovsted. If it is an amphidiploid, it must have arisen from two very similar species.

700. Toxopeus, H. J. 633.513–1.557:581.162.3
Over de factoren welke de opbrengst van kapok bepalen. (**On the factors determining the yield of kapok**).
Bergcultures 1936 : **10** : 166–75.

Flowering and the biology of pollination in the kapok are described, including certain anomalies and the degree to which the latter process is affected by external influences such as winds, rain and time of day.

Fertilization and set of fruit are also fully described and it is suggested that a heritable difference exists between forms with different sized fruit in regard to the minimum number of ovules that must be fertilized in order that the ovary may continue to develop.

In order to prevent losses in the ultimate yield from the trees, the planting of varieties with strong supple branches able to bear the weight of numerous full grown fruits or the employment of cultural methods to increase the strength of the branches are recommended. Other methods suggested in this connexion are the selection of types that do not cast their lowermost branches, such as the randoe lanang forms, or else denser planting of the trees.

An instructive discussion on various points in the lecture followed.

701. 633.52:575(47)
(**New varieties of flax produced by the Institute of Plant Industry**).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936: No. 4: 92–93.

Three new varieties have been produced which exceed the local variety in yield of scutched fibre by 40 per cent. One of the three, GDS1, is entirely free from lodging, all are resistant to rust and wilt and of high quality.

Flax breeding has been greatly facilitated by the elaboration of a method of determining fibre quality on small samples of 300–400 grm.

702. 633.52:575.1
Bērziņš, E. 633.52:581.9(47.4)
Kultūras linu iedalījums botaniskās vienībās un to raksturojums. (**Distribution of cultivated forms of flax in botanical groups and their characteristics**).
Lauksaimn. Mēnešr. 1936 : No. 9 : 419–38, 465–66.

On the basis of twelve years' research on the inheritance of measurable characters in flax (*L. usitatissimum* L.) at the flax experiment station at Stende, a classification of the cultivated forms has been drawn up. The genetic differences between the oil and the fibre types of flax are emphasized, the absence of the oil types in Latvia being mentioned (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 742). The hereditary nature of stem length, its variation and the existence of intermediate forms are referred to (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 206).

It appears that the characteristics, weight of 1,000 seeds, length of stem and of the vegetation period and the percentage of ciliate capsules, are more affected by environment than by the genotype, but that the genotype (as compared with the phenotype) is so little modified by environment as to be, practically speaking, constant. The constancy of the genotype is confirmed by the phenomenon of "degeneration" well known in flax and due, in fact, to the greater fertility and more rapid multiplication of the short forms in a heterogeneous population.

Varietal mixtures or plants from commercial seed gradually become homogeneous, one type alone predominating.

703. CERESA, G. 633.61:575(72.91)
Genetical notes on sugar cane. II. Contribution.
Proc. 9th Annu. Conf. Assoc. Tecn. Azucareros Cuba 1935 : 45–56.
Botanical descriptions of *Saccharum officinarum* and *S. spontaneum* are given, followed by observations on some of the varieties found in Cuba, including notes on their value in breeding work. The varieties so treated are Batjan, Caña Blanca, Black Cheribon, Yellow Caledonia, Carangerie, Cristalina, Cinta (*S. spontaneum*) and Chunnee (*S. Barberi*).

704. 633.61:575(73)
BRANDES, E. W., DOWELL, C. T. and BAKER, R. L. 633.61 C.P. 29–116
C.P. 29–116 to be released.
Sug. Bull. N.O. 1936 : **14** : No. 22 : p. 1.
The release of C.P. 29–116 for commercial planting in autumn 1936 has been officially approved. It is recommended as a supplementary variety to Co. 290 on certain soil types.

705. DYKERS, R. 633.61:575(76.3)
The Federal Experiment Station at Houma; a syllabus of its work.
Sug. Bull. N.O. 1936 : **14** : No. 24 : 3–8.
The work of the Division of Sugar Plant Investigations at Houma, Louisiana, includes testing the degree of resistance of promising new seedlings to mosaic, red rot and root disease and determining the proportion of resistant and susceptible seedlings among entire progenies from crosses made each year by the cane breeder at Canal Point, Florida. Mill cane deterioration, frost damage, windrowing and other problems of a physiological nature influencing the commercial utilization of varieties are also being investigated. The release of superior varieties of cane has been largely responsible for the almost three-fold increase in the farm value of the Louisiana sugar cane crop during the period of 1926–35.
The Bureau of Entomology and Plant Quarantine maintains a laboratory at Houma for studies leading to the control of insect pests of sugar cane. In relation to moth borer (*Diatraea saccharalis*) and sugar cane beetle, the growing of tolerant varieties is of importance.

706. 633.62:575:581.45
JAKUŠEVSKII, E. S. 633.174:575:581.45
(Certification and breeding of sweet sorghum).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 4/12 : 80–81.
It is found that all sorghums with juicy stems have a greyish or greenish coloured midrib, whilst hard stemmed forms have a white or whitish midrib; as the sugar content is largely associated with the degree of juiciness this is a useful character in roguing the sweet sorghums. Both green midrib and sugar content are recessive in inheritance, so that heterozygotes can easily be detected and rejected. It is also a useful character for use in breeding.

707. 633.63:575
DUDOK VAN HEEL, J. P. 633.63–1.524.4:575.127.2
L'amélioration de la betterave par la sélection génétique. (**Beetroot improvement by genetic selection**).
Bull. Ass. Chim. Sucr. 1936 : **53** : 321–30.
After a brief historical review of sugar beet selection an account is given of the methods now employed by the firm of Kuhn and Co., Naarden, Holland. Each year five to six hundred plants are chosen. Their seeds are harvested separately and observations are made during the summer on the growth and habit of the different families; each is analysed separately, the average of five different plots of each being compared with the standard. The twenty best families are then chosen; their individual plants are analysed and the five hundred best are chosen as new mother plants. These are planted in twenty different groups, each group

consisting only of plants derived from the same original mother plant, by which means a state of almost complete homozygosity is ultimately reached. For the production of commercial seed two of these homozygous "sub-races" are crossed to restore vigour; about 150 different combinations are tried each year and the best combination is made on a large scale for commercial seed production.
During the period 1838 to 1912 the average sugar content of beets was raised from 8·8 and 18·5 per cent. Since that time comparatively little progress has been made, however, and the author associates the failure to profit by genetics in the sugar beet as compared with other crops, notably sugar cane, with the sterility, the impossibility of vegetative reproduction, the absence of a great variety of chromosome numbers and the sterility of interspecific hybrids differing in chromosome number in the genus *Beta*. The present commercial beet varieties are all remarkably similar and obviously descended from a very limited number of closely related lines, probably from the original "Imperial beet" obtained by Knauer and imported into France in 1858. The author suspects that this beet was a hybrid between *B. maritima* and the white Silesian beet and regards further hybridization with the wild Atlantic *B. maritima* as the only line on which any material improvement of the present beets can be effected.
Growth studies have shewn that all the present races could produce higher yields if the climatic and cultural conditions permitted it.

708. Mazlumov, A. L. 633.63:575(47)
(Varieties and methods of selection of sugar beet.)
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 5 : 85–89.
Among the new varieties released during the period 1925 to 1934 high yields have been given by many of the varieties produced by mass selection. They are far from uniform, however, and sometimes give disappointing results. A very promising variety 28–06 was produced by group selection on the basis of observations during the entire growth period of the plants. It is one of the highest in yield and also has a very high sugar content. It was also produced in a much briefer time than by the mass selection method.
One of the most promising and early varieties was produced by individual plant selection, and at least one very productive high sugar-containing line by hybridization with the high-sugar variety Kal'nik. Individual plant selection is recommended because it furnishes more nearly homogeneous material, and data are quoted to shew that this does not necessarily lead to a loss of vigour.

709. Colin, H. and Bougy, E. 633.63:575.127.2:633.416
Les croisements entre betteraves sucrières et fourragères. **(Crosses between sugar and forage beets).**
Bull. Ass. Chim. Sucr. 1936 : **53** : No. **3** : Pp. 5.
Crosses were made between La Géante blanche Vilmorin x the sugar beet Vilmorin A and Géante rose x Vilmorin A. The hybrids had a fairly high sugar content and in the second cross surpassed the average of the parents by 1 per cent. Still more marked results were obtained from crosses between La Jaune de Vauriac and Vilmorin A. The root structure of the hybrids closely resembled that of the sugar beet parent.
A study of six self generations of the first cross shewed that only in F_6, after selecting for the sugar beet type, did the progeny become fairly homogeneous.

710. Vilmorin R. de and Meunissier, A. 633.63:575.42
La sélection chez la betterave à sucre. **(Sugar beet selection).**
Sélectionneur 1936 : **5** : 90–94.
Vilmorin's early work on sugar beet selection, modern requirements and the well-known difficulties that arise in beet breeding, including those due to cross-pollination and the resultant variation due to hybridity are discussed; also the possibility of obtaining selfed lines as pure as possible for crossing among themselves as a method of obtaining improved types. The difficulty of combining high sugar content with high yield is mentioned as well as the numerous aspects of beet breeding that form part of the programme of the International Institute for Research on Beetroots in Belgium.

711. 633.63:581.143.26:575.42
CLAUS, E. 633.63:575"793"
La sélection d'une betterave sucrière résistante à la montée en graines. (**The breeding of non-bolting strains of sugar beet**).
Publ. Inst. belge Amélior. Better. 1936 : **4** : 207–16.
This paper has already been published in Zbl. Zuckerindustr. 1936 : **44** (3) : 52–54 and is reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 247.

712. URBAN, K. 633.63–1.421
De la technique expérimentale des essais comparatifs de graines de betteraves. (**Experimental technique of tests of sugar beet seeds**).
Bull. Ass. Chim. Sucr. 1936 : **53** : 331–37.
The importance of properly conducted field tests for sugar beet is emphasized.

713. PÁZLER, J. 633.63–1.521.6:581.143.26:575(43.7)
Erkenntnisse von abnormalen Auftreten von Schossrüben bei der Zuckerrübe im Jahre 1933. (**On the abnormal occurrence of bolters in sugar beet in 1933**).
Ber. Forsch. Inst. čsl. Zuckerindustr. 1936 : **39** : 43–71.
After a concise statement of the known facts concerning the hereditary nature of bolting in the sugar beet, the occurrence of bolting in Czechoslovakia in 1933, the relative importance of various environmental factors such as locality, soil and mutation, time of sowing and the influence of variety are examined in detail with reference to the possible causes of the defect. Variety and locality in particular proved to be important factors in the causation of bolting. Differences in resistance to bolting were found not only among varieties but also among families and the elimination of susceptible families may be used as a means of increasing the resistance of particular varieties from which varieties shewing no trace of the defect might be bred. A number of such varieties are already on the market from certain firms breeding beets. Data were also obtained to shew that no direct relationship exists between bolting and sugar content so that types of beet with a high sugar content need not necessarily shew any greater tendency to bolt.

714. 633.682:576.312.32
GRANER, E. A. 633.682:576.312.35
Contribuição para o estudo cytologico da mandióca. (**A contribution toward the cytological study of manioc**).
Univ. São Paulo Escola Sup. Agric. "Luiz de Queiroz" June 1935 : Pp. 28.
Descriptions are given of the course of meiosis in microspore and megaspore mother cells and of mitosis in somatic cells. The somatic chromosome number 36 was studied in thirty-seven distinct varieties and 18 pairs were observed in all the first meiotic metaphase figures studied.

715. GRANER, E. A. 633.682:576.356.5
Chimera chromosomica na mandioca. (**Chromosomal chimaera in manioc**).
Univ. São Paulo Escola Sup. Agric. "Luiz de Queiroz" July 1935 : Pp. 13.
In place of the usual 36 somatic chromosomes sections with double number 36 were observed in certain roots of *Manihot utilissima*. Similar cases of polyploid chimaeras in the roots of other plants are mentioned and discussed.

716. IGOLKIN, G. I. 633.689
(**A new starch plant, dshau-dshamyr, from Kazakstan**).
Priroda (Nature) 1936 : No. 5 : 124–25.
The new plant, dshau-dshamyr (*Ferula dshaudshamyr*), used by the indigenous population of Kazakstan and containing 58 per cent of starch is described briefly.

717. 633.71 Moro di Pontecorvo

BENINCASA, M. 633.71:575(45)

Il Moro di Pontecorvo. (Riassunto delle caratteristiche degli ibridi Italiani di tipo Kentucky.) [**Moro di Pontecorvo. (A resumé of the characteristics of the Italian hybrids of the Kentucky type)**].

Boll. Tec. Tab. 1936 : **33** : 124–26.

As the original hybrid (Moro x Kentucky) x Kentucky bred in 1906 by Angeloni was found to have lost its valuable characteristics, the cross was repeated and the resulting hybrid though in yield slightly inferior to Kentucky proved to be earlier and less susceptible to *Thielavia*. Its economic qualities were also good. A table is given shewing the salient characteristics of the chief hybrids of the Kentucky type now cultivated in Italy.

718. HOROWITZ, B. 633.71:575(43.8)

Dotychczasowe wyniki hodowli tytoniu Węgierskiego Ogrodowego w Piadykach. (**The results so far obtained in breeding the tobacco variety Węgierski Ogrodowy in Piadyki**).

Kosmos, Lwów 1934 : **59** : 53–88.

The results of three years' experiments on the large-leaved variety Węgierski Ogrodowy (*N. Tabacum* var. *purpurea*) shewed it to consist of a somewhat mixed population comprising a number of lines differing in both morphological and physiological properties. The lines differed for instance in time of maturity, the ones that germinated earliest being also the first to flower. Lines with very high and others with extremely low nicotine content were isolated, the characteristic nicotine content being inherited from generation to generation. Positive correlations were observed between protein and nicotine content and negative between protein and nicotine content and carbohydrates. The best lines were 20 per cent higher in yield than the unselected variety, and this difference was inherited in the later generations. Some of the lines possessed a greater tendency towards the formation of light coloured leaves and others were resistant to bacterial infection.

719. HOROWITZ, B. 633.71:575(43.8)

Kilka spostrzeżeń nad krzyżówką machorki pomorskiej x machorka Selvaggio. (**Observations on crosses between the varieties of *Nicotiana rustica* Pomorska and Selvaggio**).

Kosmos, Lwów 1934 : **59** : 39–52.

Crosses were made between the local Pommeranian tobacco and the local variety from Brazil, received under the name Selvaggio Brasile, both belonging to the species *N. rustica*. The F_1 hybrid was intermediate in most respects, it was almost equal to the earlier Pommeranian parent in earliness and approached this parent more than Selvaggio in morphological characters of the leaf; the stem characters and yield were nearer those of the other parent. In nicotine content the hybrid exceeded both parents. On the whole the F_1 had combined the most desirable characters of both parents, namely the earliness, size and weight of leaf and good proportion of leaf to vein of the Pommeranian with the high yield of the Brazilian variety.

720. JOURNÉE, F. 633.71:575(49.3)

LACROIX, L. and

VAITZMAN, L.

L'amélioration du tabac en Belgique. Rapport sur le travail effectué en 1932, 1933 et 1934 à la Station de Recherches pour l'Amélioration des Plantes à Gembloux et à la sous-station de Bohan-sur-Semois. (**The improvement of tobacco in Belgium. Report on the work done in 1932, 1933 and 1934 at the Research Station for the Improvement of Plants at Gembloux and the Bohan-sur-Semois sub-station**).

Bull. Inst. Agron. Gembloux 1936 : **5** : 12–49.

Selection work was begun in 1932 with collections of numerous indigenous and foreign varieties of tobacco. Most of the former varieties proved to be heteroeous populations

and plants for seed were chosen for pedigree selection. Few of the foreign varieties were of interest, not being of the pipe tobacco type. Different Experiment Stations in Belgium were each entrusted with a particular aspect of the work, which comprised as well as selection and crossing also studies on adaptation and disease and the chemical assay of the different strains of tobacco plants. The strains were selected on a basis of observations taken during the growth period, data on yield, visual inspection of the dried leaves and chemical analysis. Among the best lines were Langue de Chien, Havré-Frisé and Bohan-Semois.
Chemical analysis is regarded as the proper method of determining the relative value of tobacco plants. A considerable number of lines of the same origin shewed a marked agreement in their ultimate placing for quality and in cases where the discrepancy between such lines was very pronounced they can often be assumed to have originated from a collection which was in actual fact a heterogeneous population.
A very large number of lines proved specially rich in nicotine so that it will be necessary in future to concentrate on selecting types with a lower nicotine content.

721. Dremljug, I. A. 633.71:575.127.2
Morphology and cytology of the hybrid of *Nicotiana paniculata* x *Nicotiana Langsdorffii*.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1936 : III (XII) : 295–98.
The hybrids when grown at Leningrad were stunted in growth, over a month behind the parents in flowering and had 88·2 per cent non-viable pollen, whereas in the continuous day of Khibiny they grew well and flowered with the parents, though still having 85·1 per cent non-viable pollen. The hybrids were intermediate between the parents in type but produced blue pollen like that of *N. Langsdorffii*.
Chromosome counts shewed 2n = 18 for *N. Langsdorffii* (contrary to Christoff's 2n = 16) and the hybrids had 2n = 21. Bivalent and trivalent chromosomes were observed at meiosis, the former mostly with only one terminal chiasma; univalents were also present, some of which divided in the first division, giving rise to daughter cells with more than 10; up to 21 were observed in the second metaphase plates.
The presence of trivalents and occasional multivalents is thought to indicate the structural hybridity of the parents.

722. Modilevski, J. 633.71:575.129:576.354.4:581.331.1
(Cytogenetical investigation of the genus *Nicotiana*. I. Cytology and embryology of the amphidiploid *Nicotiana ditagla*).
J. Inst. Bot. Acad. Sci. Ukraine 1936 : No. 7 (15) : 21–39.
In *N. Tabacum* var. Dubec (n = 24) meiosis usually follows the normal course in both anther and ovule, though certain irregularities have been observed including lagging chromosomes which fail to be included in the daughter nuclei. A complete tetrad of four megaspores is formed, the monosporial embryo sac being derived from the lowermost. Occasional abnormalities are to be seen in the mature embryo sacs.
Meiosis is for the most part normal in *N. glauca* (n = 12) but embryo sac formation follows the *Scilla* type; no tetrad is formed and the embryo sac develops from the lower cell of the dyad produced after the heterotypic division.
The amphidiploid *N. ditagla* arose from a cross between the above forms and produces 36 bivalents at meiosis. The different sizes of these bivalents are attributed by the author to their origin from different species. Irregularities observed include both precession and lagging of chromosomes, but the daughter nuclei are usually complete owing, apparently, to a rather long transition period between anaphase and telophase. Attention is drawn to the occurrence in prophase stages of accessory bodies somewhat resembling nucleoli. The daughter cells produced after the heterotypic division in the ovule commence the homotypic division, but the upper cell begins to degenerate at about metaphase or, rarely, anaphase. The division is completed in the lower cell, giving two nuclei and two cells, the lower of which usually develops into a normal, eight-nucleate embryo sac. A proportion of abnormal sacs is however formed.
There were also irregularities in the time relations of the reproductive parts of *N. ditagla*.

Thus the embryo sacs in neighbouring ovules tended to mature at different times, in an unsystematic manner; and moreover, while the styles and stigmas were mature at the time of opening of the flower the embryo sacs did not mature till some considerable interval had elapsed.
The tendency of the amphidiploid to produce abnormal embryo sacs is considered to be inherited from the *Tabacum* parent. The other irregularities are not considered to be due to an unbalanced nucleus, but rather to a disturbance of the relation between the nucleus and the cytoplasm.
The method of formation of the embryo sac in *N. ditagla* may be considered intermediate between the respective methods of the two parents.

723. Benincasa, M. 633.71:575.42(45)
Selezione del tabacco "Samsoun". (**Selection of "Samsoun" tobacco**).
Boll. Tec. Tab. 1936 : **33** : 73–74.
This variety of tobacco, introduced into Italy about 40 years ago, shews great variation in its botanical characters which has been attributed to its probable hybrid origin.
To stabilize the best type the author undertook a selection of the variety and after a consideration of various biotypes, three strains were chosen which are briefly described. Of these one, family No. 3, is held to be the best form with the most valuable economic qualities.

724. Benincasa, M. 633.71–2.42–1.521.6
Il marciume radicale del tabacco. (**Root-rot of tobacco**).
Boll. Tec. Tab. 1936 : **33** : 111–14.
The history of the spread of the root rot of tobacco caused by *Thielavia basicola* is briefly traced. Control measures in Italy include the breeding of resistant strains. The varieties most susceptible to root rot in Italy are Burley, Kentucky and Virginia, but resistant types are now available in all three varieties.

725. 633.71–2.8:575.11
Holmes, F. O. 633.71:576.1
Interspecific transfer of a gene governing type of response to tobacco-mosaic infection.
Phytopathology 1936 : **26** : 1007–14.
In *Nicotiana rustica* virus infection results in necrosis while in *N. paniculata* it produces mottling; the response of the hybrid *N. paniculata* x *N. rustica* resembled that of *N. rustica*. By repeated back-crossing of hybrids with the necrotic type of response to *N. paniculata*, followed by selfing after the third or fourth back-cross, self-fertile plants were obtained resembling *N. paniculata* but homozygous for the necrotic type of response to virus infection. The ratios obtained in the back-crosses and selfings agreed (except for certain unexplained divergent cases) with the hypothesis that the necrotic type of response is governed by a single main dominant gene *N*.
Actually there were two slightly different types of necrotic response, one characteristic of the back-cross progenies and called the unmodified necrotic type, the other occurring in some selfed progenies from the fourth back-cross, called the delayed necrotic type and somewhat resembling the type of response obtained in *N. rustica*. The segregation obtained in respect of these types of response indicated that the delayed type is governed by a recessive gene *d*, segregating independently of *N*.
The necrotic type of response was found in *N. undulata* which according to Goodspeed is one of the putative parents of *N. rustica*, *N. paniculata* being the other.

726. Hirayama, S. 633.71–2.8:581.162.5
On the germination of pollen obtained from mosaic tobacco plants.
Proc. Imp. Acad. Japan 1936 : **12** : 203–04.
The average percentage of abortive pollen observed was the same in both healthy and diseased plants and no increase such as that reported by Kostoff (Cf. "Plant Breeding Abstracts", Vol. IV Abst. 742) was noted.

727. WELLENSIEK, S. J. 633.72:575.42
Enkele resultaten van algemeenere beteekenis uit het theeselectie-onderzoek. (**Some results of more general importance, derived from the investigation on tea selection**).
Versl. 14de Ver. Proefst.-Personeel Batavia 1934 : 44–51.

Cohen Stuart's theory regarding the correlation between size of seedling and subsequent leaf production is being investigated in a series of observations comparing the yielding capacity of plants obtained by selection of the 20 per cent heaviest nursery plants with the yield from representatives of groups containing lighter plants. At the present stage of the investigation the following conclusions are warranted:—
The degree of effect of nursery selection differs with different initial material since variability is not the same in all types.
Nursery selections is always effective as regards the average production of the group of selected plants as compared with the whole population, though all the individuals selected need not necessarily be high yielders.
From a consideration of the numerous known factors involved in yielding capacity it is clear that the more precise the basis of selection is, the greater the chance that it will be effective. The same principle also applied to selection of mother trees in the plucking garden.
A certain value must also be attributed to mass selection where individual selection is impossible or as a preliminary to the latter more exact method.
A study of the reaction between the environment and the hereditary complex controlling yield shewed that those plants that are genetically higher yielders are less affected by external growth factors than the low producers.

728. WELLENSIEK, S. J. 633.72:575.42
Onderzoekingen over quantitatieve theeselectie II. (Gegevens over vijf reformzaadtuinen en algemeen bespreking der methodiek). [**Researches on quantitative tea-selection II. (Data on five reform seed gardens and a general discussion on the methods).**]
Arch. Theecult. Ned.-Ind. 1936 : **10** : 1–49.

In continuation of the work reviewed in "Plant Breeding Abstracts", Vol. V, Abst. 1078, the laying out of five reform seed gardens is described with a general discussion on methods and their development and the modern methods as represented by the "selected tea seed garden". This method includes three stages (1) nursery selection of stocks, (2) selection of mother trees, testing of clones and ultimately of the progeny from crosses of certain clones, and (3) budding the stocks with material selected under (2) above.
The data representing the results obtained from five reform seed gardens are presented in tabular form and the lay out and methods of plucking used are recorded, while inferences of a more general nature relating to nursery selection, efficiency, etc., are to be published separately. The figures for the Tjibioek estate shewed that centre plants as a whole out-yielded border plants probably owing to unfavourable environmental effects, due to root competition, etc., in the unenclosed garden.
On the Tjinjiroean estate, visual selection which was used to reduce the number of experimental plants before the plucking proved most successful and was, therefore, used in later cases.

729. 633.72:575.42(92.2)
HOEDT, T. G. E. 633.72–2–1.521.6:581.13
Overzicht van de werkzaamheden van het Proefstation West-Java betreffende de theecultuur in 1934. (**Review of the work of the West Java Experiment Station regarding tea cultivation in 1934**).
Bergcultures 1935 : **9** : 815–27.

This report of a lecture, which is written from the economic standpoint, deals with the manuring tests, with methods of plucking and pruning and with tea selection.
Wellensiek's work on nursery selection of tea (Cf. "Plant Breeding Abstracts", Vol. III, Abst. 706, Vol. IV, Absts. 214 and 1058) is noted and special mention is made of the value of using robust, strong plants for planting the nurseries and of basing nursery selection on the plant weight. The advantage incidental to nursery selection is that by choosing the heaviest

plants the best stocks for buddings are obtained and grafts take better on such stocks. Seed selection on the basis of the specific gravity tested in sugar solutions can also be used as another way of obtaining highly homogeneous nurseries with almost 100 per cent of very good plants for use both as plucking gardens and for stocks.
Nursery selection also provides a means of identifying the initial plant material likely to be suitable for seed production. Such plants must be tested for yield in seed gardens before being finally approved as seed producers and after that the seed from the various seed gardens must be tested, since the populations of parent plants in the seed plots are very heterogeneous and only after the results obtained have proved constant for some years can they be regarded as of definite practical value. After that, seed plots can be laid down with clones of desirable parent plants and at the present time a large number of mother plants from various estates await the tests of their vegetative progeny.
Laboratory tests of small samples of leaf have been begun with the object of ascertaining the quality of the various clones.
Contrary to the general opinion, the Station holds that for tea, as for other plants, vegetative multiplication could be used as a way of obtaining a product of high quality once suitable initial plant material has been attained.
As regards resistance to *Helopeltis* and red rust, indications have been obtained that susceptibility is correlated with a low starch reserve and investigations on this point are to be continued. In the meantime the choice of vigorous healthy plants is recommended as a preventive against these pests.

730. Wel, A. R. van 633.72:581.48:575.42–181
Proef met theezaad van verschillenden diameter. (**Experiment with tea seed of different diameter.**)
Bergcultures 1935 : **9** : 419–20.

No difference in quality was noted between large and medium-sized seed, but small seeds gave smaller and less vigorous plants. Selection for seed size is recommended for seed below a certain diameter, which is decided according to the type of the seed.
Germination tests shewed that with small seeds rapid germination gave the best results; in the case of large and medium-sized seed, rapidity of germination made no difference in the resulting plants.

731. Ferwerda, F. P. 633.73 Conuga
Conuga-koffie. (**Conuga coffee**).
Bergcultures 1934 : **8** : 601–02.

The varieties of coffee called Congensis or Congensis hybrids are derived from crosses between *Coffea congensis* and *C. uganda*, or *C. canephora*, or unknown forms resembling Robusta, and bear little resemblance to the true botanical *C. congensis*. The Congensis hybrids do, however, possess the typical columnar shape of the true *C. congensis*, though they are much more vigorous; they also have a leaf structure which is similar to that of Congensis proper and possibly accounts for their resistance to leaf disease. In leaf shape they resemble the Robusta forms and in berry and bean the *C. arabica* type. The yield of the hybrids is much higher than that of true *C. congensis*.
All the utility Congensis forms have been selected from open pollinated Congensis types that have been imported into Java and they must be vegetatively propagated if the required characteristics are to be maintained.
The name *Conuga* is suggested instead of Congensis or Congensis hybrids as a suitable designation for these utility types.

732. Cramer, P. J. S. 633.73:575(92)
L'amélioration du matérial à planter dans la culture du caféier aux Indes Néerlandaises. (**The improvement of planting material for coffee cultivation in the Netherlands Indies**).
Agron. Colon. 1935 : **24** : 101–09.

The first essential in a successful programme of coffee breeding has been found to be the introduction of the wild species related to the cultivated forms, which are still to be found

growing wild in the forests. This was done in Java and a great number and variety of new species were discovered, some of which have replaced the original *Coffea arabica* on account of their greater resistance to *Hemileia*. After *C. liberica* had been grown for some time it seemed to lose its resistance, apparently owing to an increase in virulence on the part of the fungus. Great variation has been observed in all the wild species studied, and even the *C. arabica* grown in Abyssinia proved much more variable than that grown in Java. This variation, therefore, gives a good basis for selection. By individual plant selection over a number of generations, considerable yield increases have been effected in Java in *C. liberica* and *C. robusta*. The best plants have been multiplied by grafting, giving rise to monoclonal plantings designed to produce seed for large-scale planting. A very good root stock has been found among the progeny of a hybrid of *robusta* with *Konilou*, a species closely related to *robusta*.
Several spontaneous hybrids of great promise have been found and preserved by grafting. Several hybrids, including the Kalimas and Kawisari, between *C. liberica* and *C. arabica* were found by planters and at later dates hybrids have been found of *excelsa* x *liberica*, *robusta* x *excelsa*, *uganda* x *congensis*, *robusta* x *arabica* and many other combinations. Most of the *congensis* hybrids are of good quality and yield well. All hybrids have to be multiplied vegetatively.
Still further improvement is anticipated from an extension of this work and from further seed selection of *C. robusta*.

733. 633.73:575.42
STOFFELS, E. 633.73:575.11
La sélection du caféier arabica à la station de Mulungu. (Premières communications). [**The selection of arabica coffee at the Mulungu station. (First communication)**].
Publ. Inst. Agron. Congo Belge 1936 : Sér. Sci. No. 11 : Pp. 41.
The behaviour of two groups of arabica coffee, one with brown-leafed terminal shoots BB and the other with green, BV, was compared. The effect of the environment on variation was very marked but the BB group proved much more adaptable than the BV group and less susceptible to Dieback and Black Tip and to over-production.
Most of the BB strains tested were homozygous with regard to the colour of their terminal shoots but in some cases, although the numbers were too small for certainty, there were indications of a monohybrid ratio for the characters BB and BV. Which character was dominant depended on the mother plant.
In most other morphological characters there was complete homozygosity. Experiments proved that arabica coffee is naturally self-pollinated. The variation of the beans was very slight in arabica but their size might be improved.

734. LAMBERS, M. HILLE RIS 633.73:575.42(92.1)
Eenige mededeelingen over den huidigen stand van de koffieselectie. (**The present condition of coffee selection**).
Bergcultures 1935 : **9** : 557–63.
The lecturer discusses work that is being done on crossing and selection and gives some explanation of general principles. Only about 5 per cent. of mother trees give good buddings. He suggests that most of the mother trees were too old when selected, and that in future younger trees should be selected especially among the seedlings of superior mother trees.
The general scheme of selection is the establishment of both seedlings and buddings from superior mother trees as a basis for further selection of new mother trees and multiplication of buddings.
Crossing was started in 1927. The results are in many ways surprising and cannot perhaps be predicted. In some crosses numerous abnormalities appear which are rare or absent in the parents, but they are welcomed, as good characters also will stand the chance of being increased in the same way.
Details are given of the volume of 100 fruits produced by the parents and reciprocals in two crosses. Both SA 24 x 113 and SA 116 x 94 have bigger beans and stronger growth than ordinary seedlings of the parents.

The first year's yields already shew differences not all in favour of the crosses. Details are given for two years for SA 24 x 113 with a mean yield of 7·4 kati greater than seedlings from either parent (5·6 and 4·1) and SA 116 x 94 reciprocals with intermediate yield 4·3 and 5·1 kati as compared with 2·4 and 6·4.
Families also differ in the numbers of seedlings chosen as new mother trees. A table of several crosses gives a mean of 38·3 per cent chosen in 1935 from the crosses and 12·5 per cent from the ordinary seedlings from the same parents. The differences in yield between seedlings and crossings in the first proper yield year, 1934, were not great but will be more this year. Yields of reciprocals are practically equal. SA 61 is remarkable: it is of little value as buddings, only average as seedlings, but very good in a number of crossings.
As far as possible, crossing is carried out between all combinations of noteworthy mother trees or their buddings, and the seedlings planted in test plots. Back-crosses are also being made and crossings of two families, giving a combination of four parents, have already been established.
Other sorts of coffee have been crossed. Special mention is made of the cross *Coniga* x *robusta* with the object of obtaining self-fertile clones useful for high damp estates.
Mixed and monoclone seed is discussed. The most economical and flexible method of obtaining crossed seed is to use pure plantings of the female parent clone and spray (dust) with pollen of the desired male. Thus as further knowledge is obtained other pollen can be used in later years. Already seed has been obtained from monoclone plantings of SA 24 pollinated by 113, and 13 x 56. In monoclone SA 13 practical self-pollination gave four berries per cluster, but crossing with SA 56 gave a mean of 27.
In the discussion it was stated that cross-pollination does not extend beyond six rows at the most, and that it is preferable to collect pollen on the first day of flowering and use it on the second. L.E.M.

735. Lambers, M. Hille Ris 633.73:578.082:581.481
Koffie-tweelingen uit stumps. (**Twin coffee plants from stumps**).
Bergcultures 1934 : **8** : 497–99.

The method used by Ramaer for obtaining two plants from one *Hevea* seed has been tried at Besoeki and Malang with young coffee seedlings. Success, however, was very dependent on skill in the longitudinal division of the thin hypocotyl and tap root, and the divided seedlings shewed great reduction in growth.
In January 1933 at Malang Robusta seedlings about one year old were stumped, washed and the stem and tap root longitudinally divided. The wound surfaces were not specially protected. By January 1934 out of 95 halved stumps 64 pairs of twins were alive. Out of 10 control stumps one had died.
Most failures occurred with the thinner, less vigorous stumps. Callus formation was best with more vigorous plants in the wet season. Growth compared well with the controls.
L.E.M.

736. Krug, C. A. 633.73:581.162.3:578.08
Contrôle da pollinização nas flôres do caféeiro. (**Control of pollination in coffee flowers**).
Bol. Tech. Inst. Agron. São Paulo 1935 : No. 15 : Pp. 12.

Observations on the morphology and biology of the flower in the local Brazilian coffee (*C. arabica*) are reported. Self-fertilization was the rule though transference of pollen by insects and even by the wind is possible.
The technique of self-pollination and hybridization is briefly described. With the former an 80 per cent set was obtained. For crossing, emasculation was performed by means of a pair of scissors with an incision towards the end so as to cut the corolla, without damaging the style within. The corolla is then removed, leaving the style and stigma exposed ready for pollination and bagging. In this way 6,215 flowers were pollinated artificially in 1933 and 3,118 fruits were collected, giving over 6,000 hybrid seeds, representing a set of over 50 per cent.

737. FERWERDA, F. P. 633.73:581.162.3:581.483
Het voorkomen van voosboon bij koffie en zijn samenhang met bevruchting en vruchtzetting. [**The occurrence of "voosboon" (spongy bean) in coffee and its relation to fertilization and fruit setting**].
Bergcultures 1935 : **9** : 500–09.

It is known that fruit setting is poor in monoclone plantings of Robusta, but other abnormalities result from selfing, e.g. "voosboon" (spongy bean), i.e. a seed that is incompletely or not at all developed. This faulty development mainly concerns the endosperm, which forms the chief mass of the coffee bean. The frequency of 'voos' beans varies from year to year, and is not always greatest in hybrids. The effects of various percentages of 'voos' beans on yield are tabulated.

Cross- and self-pollination of seven types of Robusta and one Quillou shew clearly that a high percentage of 'voos' beans is associated with low fruit setting. A study of six Conuga types also shews more 'voos' beans and lower fruit setting from open pollination, but the differences between crosses are less clear. In Liberica-arabica hybrids the percentage of 'voos' beans varies only slightly, but Q.P. as male parent gives rather more. Q.P. and Kedaton (both Robusta-excelsa hybrids) are self incompatible, but when cross-pollinated high fruit setting and few 'voos' beans again go together.

In Robusta both pollen and egg cells are fertile, but in the less successful combinations pollen tubes grow slowly and do not all reach the egg cells, which undergo some partial development and 'voos' beans result.

The result of self-pollination is clearly shewn in the greater frequency of 'voos' beans within a monoclone block than in the outer rows exposed to cross-pollination. Weather unfavourable for pollination increases the numbers of 'voos' beans in seedlings. In hybrids much of the pollen is imperfect and empty, and so fruit setting is poor and 'voos' beans abundant even when crossed.

Thus in Robusta 'voos' beans can be avoided by mixed clone planting and by artificial pollination. In Conuga also appropriate mixing will help, but this is no use in hybrids.

L.E.M.

738. 633.73:581.162.32:578.08
LAMBERS, M. HILLE RIS 633.73:575.12
Over kunstmatige kruisbestuiving van koffietuinen. (**On artificial cross-pollination of coffee plantations**).
Bergcultures 1934 : **8** : 880–85.

Fruit setting of Robusta coffee is increased by conditions favourable to cross-pollination, such as sunny, dry and slightly windy weather. To lessen the effect of unfavourable weather shade trees should not be too dense.

Pollination can be increased even by shaking the trees or spreading the pollen with feather brushes; or, better still, by directing a strong current of air through the trees by means of hand or motor dusters as used for sulphur dusting.

If rain falls the pollen loses its vitality and must be replaced.

Pollen from other estates can also be used, and if kept dry over quicklime will retain its vitality probably from three to four weeks.

An experiment is described, with a Björklund duster in a monoclone planting in which fruit setting was particularly poor. Very little pollen was necessary and was carried at least 20 metres from the duster.

As the stigmas remain receptive for at least two days, operations interrupted by rain can be continued later.

Special problems need consideration and further experiments are desirable.

Pure clone seed can be obtained from large monoclone blocks. The seedlings of the cross SA 24 x 113 are better than either parent. As SA 24 is the better mother, existing monoclone gardens of this clone can be used and pollen from SA 113 brought and dusted on to it. Possibly two separate crosses could be made in one garden in one year from early and late pollinations in a long flowering season.

L.E.M.

739. Teixeira, E. F. 633.73:581.45:575.22
Variações morphologicas do *Coffea arabica*. (**Morphological variations of *Coffea arabica*).**
Rev. Dep. Nac. Café, Rio de J. 1936 : **4** : 201–03.
A form of *C. arabica* var. *polysperma* is described, the characteristic of which is the great variability in the number of leaves per node. In place of the normal 2, individuals with 3, 4, 5, 6, 7, 8, 9, 12, and even 16 were found. The size of the plant was in inverse proportion to the number of leaves per node.
A comparison with the variety known as Hibrido Redondo convinced the author that the two varieties were identical. The diploid chromosome number 44 was observed in both.

740. Veen, R. van der 633.73–1.421
Onregelmatigheden in vakkenproeven bij koffie-aanplantigen. (**Irregularities in plot tests in coffee plantings).**
Bergcultures 1934 : **8** : 354–56.
Marked irregularities in the production from the various plots at the Besoekisch Proefstation are a source of difficulty in evaluating the results. It is suggested that these irregularities were due to climatic differences acting in a normal year for a short period, i.e. the direction or strength of the wind and the moisture conditions during the hours of flowering when pollination occurs.

741. 633.73–1.547.1:575
Gandrup, J. 633.73:581.48–181
Verdere onderzoekingen over de ontkieming van rondboonzaad. (**Further investigations on the germination of round bean seeds).**
Bergcultures 1935 : **9** : 54–56.
Previous experiments (Bergcultures, 19th May, 1934) shewed no difference between the germination of round and flat beans of Conuga coffee. The same methods have been repeated with seed, all fresh and picked on one day, from a monoclone planting of Robusta SA13.
From 6th June to 28th September 97 per cent of flat and 96 per cent round bean seed germinated, and the progress of germination (as shewn by graphs) was almost identical.
Thus there is no reason for not planting round bean seed, provided there is no hereditary tendency of the mother tree (or clone) to produce many round beans. This is certain for tested clones, but not for ordinary plantations.
If a tree has this tendency it will be transmitted by its normal flat bean seed as well as by the round.
There was no (significant) difference between the mean lengths of flat and round bean seed, nor between the germination of the third shortest and the third longest seeds of either group.
The difference from Schweizer's results is discussed.
There was no difference between the plants from small and large seeds. L.E.M.

OIL PLANTS 633.85

742. Myers, W. M. 633.854.54:581.48:575.11–183
A correlated study of the inheritance of seed size and botanical characters in the flax cross, Redwing x Ottawa 770B.
J. Amer. Soc. Agron. 1936 : **28** : 623–35.
Redwing has light blue flowers, small brown seeds and cilia on the margins of the false septa in the boll, while Ottawa 770B has white flowers, medium large yellow seed and non-ciliate false septa.
Monofactorial segregation for flower colour was observed, blue being dominant. There was, however, a significant deficiency of white flowered individuals, part of which could be accounted for on a basis of their lower viability as mature seeds or as plants, or both.
All blue-flowered individuals had brown seeds and all white-flowered plants had yellow seeds.
The segregation for hairiness of the false septa indicated a single, incompletely dominant factor for hairiness.

The inheritance of seed size was found to be governed by multiple factors, with partial dominance of large size. Plants with the seed weight of each parent were recovered in 359 F_2 plants, but as shewn by a study of variances, no pure breeding lines of either parental type were recovered from the 100 F_3 families studied, with one doubtful exception. The number of factors concerned could not be determined, but was probably more than three. A correlation of 0·684 was obtained between the weight per 50 seeds of the F_2 plants and the mean weight per 50 seeds of their F_3 progenies.
χ^2 tests for independence shewed no association between the factors for seed weight, for cilia on the false septa and for flower and seed colour.

743. Aman'eva, S. V. 633.854.78:575.11
(Breeding sunflowers on a genetical basis).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 50–54.
By continued inbreeding over a period of 6–10 years it has been possible to select lines which are pure for a number of characters. When these were intercrossed, heterosis almost invariably occurred. The presence of the black layer of cells below the hypodermis which determines the resistance to moth and *Orobanche* proved in the F_1 to be dominant and 3 : 1 ratios occurred in F_2; the actual degree of development of the black layer was variable, however, and modifiers may be present. Yellow pollen colour also behaved as a simple dominant, independent of the black layer. Striping of the seed coat was dominant and swelling at the base of the seed was recessive and linked to the factor for striping, though crossing-over was observed in certain individuals. The ray form of the ray florets was dominant to the tubular form and yellow colour to cream, these two factors being also independent; a further factor *A* gives red in presence of *B* for yellow. Excessive venation of the leaves was also a simple recessive and white seed coat a complex dominant over black.

744. Ščibria, N. A. 633.854.78:575.127.2:635.24
Hybrids between the Jerusalem artichoke (*Helianthus tuberosus* L.) and the sunflower (*H. annuus* L.).
C.R. (Doklady) Acad. Sci. U.R.S.S. 1936 : **2** : 193–96.
Crosses have been made between the most valuable agricultural forms of *H. annuus* (2n = 34) and of *H. tuberosus* and *H. macrophyllus*, both with 2n = 102. Eighteen plants were obtained from the cross *H. tuberosus* x *H. annuus* in 1935 and of these, fourteen were undoubted hybrids. One natural hybrid was also obtained. The hybrids were in most characters intermediate between the parents, though there was a greater resemblance to the female than the male parent. The immunity of the artichoke from *Puccinia helianthi* Schrad. was fully dominant; in one cross, tuber formation was dominant, while in another, segregation for this character occurred. No character shewed complete dominance of the paternal type.
Heterosis was observed in certain characters, e.g. density of foliage and of branching, height, etc. The natural hybrid, which apparently came from an oil sunflower, was particularly vigorous in growth, reaching a height of over 3 metres.
All hybrids flowered and some produced a small amount of seed, also intermediate in type.
The somatic chromosome number of the hybrids was approximately 68.
The possibility of crossing these two species suggests new departures in sunflower breeding, the production of a perennial tuber-bearing sunflower immune from rust and from *Orobanche cumana*, etc., being one of the most attractive possibilities. Some of the new forms appearing among the hybrids are of distinct practical interest and the heterosis could also probably be put to practical use.

745. Plaček, E. M. 633.854.78:575.14
(The importance of inbreeding as a method of breeding sunflower).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 1 : 44–50.
By the method of individual family selection it has been possible to produce lines such as No. 169 which are entirely free from attack by the A race of *Orobanche*. Such lines quickly tend to lose their purity however, and it was decided to apply inbreeding. No loss of vigour

was observed on inbreeding but the fertility varied greatly in different lines, the number of seeds per plant ranging from nil to 1,175; great variation was observed in the segregates in respect of earliness, size, branching and disease resistance. Moreover, the degree of fertility is similar in both mother plants and progeny, shewing it to be an hereditary character. One line isolated by inbreeding, No. 137, proved very resistant to rust as well as to *Orobanche* and the moth *Homeosoma nebulella*, as well as being above the standard No. 169 in yield and oil content. Many other races of value in cultivation or as parents have been obtained by the same method, and crosses are to be made between them for the production of improved types. Both interracial and interspecific hybridization is planned.

746. Morozov, V. K. 633.854.78:575.14:575.125
(Judging inbred families of sunflower by means of diallel crossing).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 2 : 55–59.
Different combinations of inbred lines gave different degrees of heterosis; some hybrids out-yielded the parents by more than 100 per cent; the best of them gave a yield greater than the standard Russian variety No. 169. The best parental combinations are indicated.

747. 633.855.34:575:581.162.5
631.531.12(67.5)
Les semences améliorées. Fournitures de grains d'Elaeis à Yangambi. **(Improved seed. Providing Elaeis seed at Yangambi).**
Agric. Élev. Congo Belge 1936 : **10** : 133–34.
The Yangambi Station is actively engaged in the production of improved seed of *Elaeis*.
A marked correlation has been found to exist between the high number of female inflorescences and the excessive reduction of the kernel from the female parent on the one hand and the proportion of sterile progeny on the other. Only trees producing an average of 6-14 bunches and having large kernels appear less subject to this hereditary degeneration consisting in complete or partial sterility of some of the progeny and terminating almost invariably in a pronounced regression of the kernel in the normal individuals.
The strict criteria regarding the weight and number of bunches and kernels, fruits, etc., on which selection of individual trees for seed production is based are enumerated.

RUBBER PLANTS 633.9

748. 633.91:575.42(67.5)
Les Hévéas sélectionnés à Yangambi. **(Selected rubber trees at Yangambi).**
Agric. Élev. Congo Belge 1936 : **10** : p. 136.
From the selected material in the Inéac plantations at Yangambi yields of 1500–2000 kg. are expected and have already been obtained from numerous clones now in bearing.

749. *Schweizer, J. 633.912:575(92.2)
Superieur *Hevea*-plantmateriaal in den Oosthoek. **(Superior *Hevea* planting material in East Java).**
Bergcultures 1934 : **8** : 678–88.
An account of the performance of various clones and mother tree seedlings.

750. *Hoedt, T. 633.912:575.42(92.2)
Van den Proefstationsdienst korte mededeeling van het Proefstation West-Java No. 42. Heveaselectie op Prang Besar Estate. **(A short report from the West Java Experiment Station No. 42. Rubber selection on Prang Besar Estate).**
Bergcultures 1935 : **9** : 831–32.
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from artificial crosses. Five out of the six clones for which yields are given shewed practically continually increasing yields from 4½–11½ years of age. Very high yielding individuals should, it is believed, be found in certain plantations and according to test tapping some of the new clones yielded 4–5 times more than the controls, Soengei Reko 9 and PB 23.

751. *Maas, J. G. J. A. 633.912:575.42(92.2)
Da selectie van *Hevea* bij 's Lands Caoutchoucbedrijf. (***Hevea* selection at the Lands Caoutchoucbedrijf).**
Bergcultures 1934 : **8** : 759–62.

The above selection station is mainly concerned with its own new material but other clones are included for comparison.
Clone L.C.B. 870 is mildew resistant, and it is hoped to bud it on to other clones at a height of 2–2½ (? metres).
Reference is made to the large-scale selection work on the H.A.P.M. estates in Sumatra.
In 1927 the L.C.B. selection work was systematized. The best trees were picked out from some 5,300 tapping tasks and 3,754 were tested. Eventually buddings were established from 260, i.e. 1/6000 of the total estate trees. The yield intensity of 1,953 selected trees was 425 per cent. of the general mean, which agrees closely with the H.A.P.M. result. Of the 260 pedigree recorded trees those in younger fields had a yield intensity of 550 per cent, and over three years A.B. tapping the modal and highest yields were 15 and 30 kg. per year.
To increase the certainty of selection many clones are tested. Generative selection has to depend more on the mother trees themselves, but further work should lead to the elimination of defects by crosses between the best clones.
In the hope of finding new clones a few buddings are regularly made from crossed seedlings. With the object of raising seedlings for direct use on a large scale, isolated seed gardens of two suitable clones have been laid out. Self-pollination has given little success.
The lay-out of test gardens with clones in repeated rows or blocks is described.
Some results of the first year's tapping are given. A.V. 49 and 152 were resistant to wind-break, which is important at Tjikoempaj. L.C.B. 146 and 103 gave much better yields than Ct. 88.
The first results of the selection are regarded as very promising. L.E.M.

752. Vollema, J. S. 633.912:575.42:581.165.1
Indrukken van de rubbercultuur in Sumatra's Oostkust en Malakka. (**Impressions of the rubber cultivation on the East Coast of Sumatra and Malaya**).
Bergcultures 1936 : **10** : 266–73.

This paper includes observations on the results of selection work, as already described in "Plant Breeding Abstracts", Vol. VI, Abst. 1341.
In Malaya when the first artificial crosses had been made in 1928, buddings were taken from all the one year old seedlings obtained, so that the difference in age between the latter and the buddings was slight and a saving of about six years was effected.
It is also mentioned that at the first test tapping on the Prang Besar estate, West Java, the "second generation clones" produced on the average more than the two controls PB 23 and SR 9, while the best of the new clones yielded from 4–5 times as much. Further data on these promising preliminary results are awaited.
The Rubber Research Institute in Malaya recommends the planting of buddings exclusively and on a large scale. Pilmoor D 65, which greatly resembles BD 5 in habit but grows better in Malaya, is regarded as one of the best Malayan clones and recommended to planters, as well as the Malayan clones Pilmoor 84, Prang Besar 25, 86, 180, 186, and others.
The small amount of data available, owing to the rubber restrictions, shews that on the East Coast of Sumatra, large areas under plantations of mixed buddings of untested clones yield when fully grown about 1,100 kg. per hectare unmanured, and with nitrogenous manures from 1,300–1,400 kg. per hectare, i.e. double the yield of plantations from unselected seed

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under similar conditions. In Malaya an area of 750 hectares under plantations of buddings produced in the first tapping year about 450 kg. per hectare. The unanimous opinion is that an output of at least 2,000 kg. per hectare could be reached with such approved planting material under suitable conditions.
Still higher hopes are entertained regarding the second generation clones.

753. Hoedt, T. G. E. 633.912:581.165.1(92.2)
Overzicht van de werkzaamheden van het Proefstation West-Java inzake de rubbercultuur gedurende 1934. (**Review of the activities of the West Java Experiment Station in relation to rubber growing in 1934**).
Bergcultures 1935 : **9** : 645–56.
Three hundred clones are under observation, and practically all the promising clones of the Dutch East Indies and Malaya are included, with three rows of five trees of each. Tapping yields are recorded three times a month and other characters of the trees are also observed.
Of the clones planted in 1923, PR 107 is the best in all respects. AV 71 and 256 have undesirable characters.
Details are given of the arrangements for multiplying and ensuring the purity of the clones.
In 1929, 1930 and 1931 nearly 2,000 seedlings from artificial pollinations have been planted.
Several families planted in Tjiomas in 1929 have already given 1·8 and 1·9 kg. of rubber per tree per year in their first tapping year.
A general discussion follows of seed gardens planted with recommended clones.
Plots of open-pollinated and clone seedlings in West Java have given yields of 800-850 kg.per hectare in their ninth year, and 1,000 kg. per hectare in the fourteenth year has been recorded.
The 1926–27 plantings of Wangoenrja seedlings gave 425 kg. per hectare up to the end of October 1934, in their eighth year.
Rejuvenation, new cover crops, tapping systems and manufacture are then considered.
L.E.M.

754. Lapin, A. K. 633.913:575(47)
(**Rubber and gutta-percha plants of the U.S.S.R.**)
Priroda (Nature) 1936 : No. 7 : 110–23.
Descriptions are given of the various new rubber plants discovered as a result of the Soviet collecting expeditions, starting with the best, *Scorzonera tau-saghyz* with an average content of 20 per cent. of rubber of high quality in the dry root, together with a suitable amount (5 per cent) of resin. The actual rubber content in different individuals varies from 6 to 38 per cent, and similar variations are observed in other characters, giving admirable scope for breeding.
Next comes *Taraxacum kok-saghyz* with an average content of 17–18 per cent rubber and 5–6 per cent resin; here again the rubber content varies from 3 to 28 per cent. This plant is more adapted to northern conditions than the former, and the variability in all characters makes it an equally promising object of breeding. The same applies in a lesser degree to *T. megalorrhizon*, containing 6 per cent of rubber, guayule (10–14 per cent), *Solidago* (round about 12 per cent) and certain others.
Similarly gutta-percha can be obtained from *Euonymus verrucosa* and *Eucommia ulmoides*.

FRUIT TREES 634

755. 634:575(77.1)
635:575(77.1)
Horticulture at the Ohio Agricultural Experiment Station, Wooster, Ohio.
Spec. Circ. Ohio Agric. Exp. Sta. 1936 : No. 48 : Pp. 66.
A review of recent work at the Wooster station.
Varieties of apples and pears have been tested and extensive breeding work is carried on with apples, the aims being late blooming, late keeping (February onwards), high quality, harvesting season in October and relative freedom from scab, bitter pit and certain physiological diseases. The most promising seedlings obtained so far have had as parents Red Spy,

Northern Spy, Rome Beauty, Gallia Beauty or Jonathan. Over 2,800 seedlings are now in the nursery, a great proportion of which are just coming into bearing.
Studies have also been made on the pollination of pears, on the development of the embryo sac in triploid apples, varietal susceptibility of apples to spraying and numerous other orchard topics.
Varieties of peaches, plums, cherries, raspberries, red currants, strawberries and grapes have been tested.
Breeding work is carried on with tomatoes, lettuce and cucumbers. The Marhio tomato has been crossed with another Marglobe type, Gorgeous, with the aim of producing a type with the desirable qualities of the Marhio but lacking its undesirable tendency to dwarf when trained to a single stem. Strains of the Globe tomato are being crossed *inter se* in the hope of obtaining a segregate without large rough tomatoes; it is hoped by this means to avoid a cross with another variety. The tipburn-resistant strain of Grand Rapids lettuce is proving popular. A cross between two unrelated inbred lines of cucumber is shewing promise.
Variety tests have been made with tomatoes, cabbage, peas, head lettuce and potatoes.

756. Miedzyrzecki, Ch. 634:575.1(64)
Le rôle de la génétique dans le progrès de l'horticulture utilitaire. (**The role of genetics in the progress of economic horticulture**).
Lab. Génét. Exp. Fruitière et Maraîchère Groupe Lacarelle, Immeuble Balima, Cours Lyautey Pp. 6.
The progress already realized in horticulture by the improvements in cultural methods is briefly outlined, followed by a simplified account of the genetical basis of fruit breeding and some of the more important results obtained thereby. The present position of horticulture in Morocco is then reviewed.

757. Kemmer, E. and Schulz, F. 634.1–1.541.11:575
Die Bedeutung des Kernobstsämlings als Unterlage. (**The importance of pome fruit seedlings as rootstock**).
Landw. Jb. 1936 : **83** : 297–319.
Observations are made on the behaviour of a number of varieties of triploid and diploid apples and pears in respect of number of seeds per fruit, their germinating capacity, the survival and development of the young seedlings. In all these respects the triploids were much inferior to the diploids and were all quite unsuitable for use for seedling rootstock production. Some of the diploids, such as Cox's Orange, also gave low values, in this case possibly owing to its origin as a seedling from a triploid. It is necessary to test all varieties, therefore, even diploids, before using them as a source of rootstock seedlings.

758. Nebel, B. R. 634.11:575.183
Metaxenia in apples.
J. Hered. 1936 : **27** : 345–49.
The paper includes a survey of earlier observations on metaxenia and of the author's work on the subject (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 240 and Vol. VII, Abst. 67). The conclusion is reached that pollination by different kinds of pollen can lead to slight but consistent physiological differences in the tissues of the fruit, but that direct and specific influence of factorial characters does not occur.

759. Dahl, C. G. 634.11:576.16
***Malus prunifolia* Borkh. and *Malus baccata* Borkh. as ancestors of cultivated apple varieties.**
Svensk Bot. Tidskr. 1936 : **30** : 483–92.

Dahl, C. G.
Härstamma våra äpplesorter från en enda art? (**Are our apple varieties derived from a single species?**)
Sverig. Pomol. Fören. Årsskr. 1936 : **37** : 255–57.
Historical evidence is adduced to refute the view that *M. prunifolia* and *M. baccata* could

have been the original parents of Astrakhans or other commercial apples grown in Europe. Only one variety of proved commercial value, namely the large-fruited American apple Wealthy, is a second (or third?) generation hybrid from the cross *M. prunifolia* (or *baccata*) x *pumila*. The hybrids of similar parentage that are being raised at Ottawa and Geneva are regarded as likely to prove promising for colder climates.
A bibliography is added (Cf. "Plant Breeding Abstracts", Vol. VI, Absts. 745 and 747).

760. Gorczyński, T. 634.11:576.312:581.3
Untersuchungen über die Entwicklung der Samenanlage und des Embryosackes bei der Apfelsorte "Schöner von Boskoop". (**Investigations on the development of the ovule and the embryo sac in the apple variety Boskoop Belle**).
Acta Soc. Bot. Polon. 1934 : **11** : 87–108.
Observations on the phases of development of the ovule and the embryo sac and pollen tube behaviour in the Boskoop Belle apple are analysed and the results contrasted with the findings of Veh (Cf. "Plant Breeding Abstracts", Vol. IV, Absts. 464 and 1081) and others.
The writer believes that the possibility exists of normal embryo sac formation in the Boskoop Belle, the ovule of which on fertilization may develop into a normal embryo (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 778).

761. 634.13:575
Gould, H. G. and Johnston, S. 634.13 Campas
The Campas pear.
Quart. Bull. Mich. Agric. Exp. Sta. 1935 : **17** : 155–57.
Descended from a tree of unknown origin belonging to a Mr Campas, the Campas pear closely resembles the Kieffer, but is superior to it in canning qualities.

762. 634.13:576.312.35:576.356.5
Adati, S. 634.13(52)
(**Investigations on the chromosome numbers in the species of *Pyrus* cultivated in Japan**).
Bot. and Zoology, Tokyo 1935 : **3** : 1445–50.
In 32 varieties of *Pyrus* the same chromosome number n = 17 was found. All were therefore diploid forms. Darlington's observations regarding "secondary association" could not be confirmed. The author believes the *Pomoideae* to be allopolyploid.
The seedless pear Mukaku-Ri also proved to be a diploid with normal reduction division in the pollen mother cells, sterility being due to defective stylar development.

763. Zorin, F. M. 634.13:581.143.32:581.47
(**Curious bud growths resembling a fruit in the pear**).
Sovetskaja Botanika (Soviet Botany) 1935 : No. 6 : 95–99.
A description is given of the false fruits referred to by Michurin (Cf. "Plant Breeding Abstracts", Vol. V, p. 376) and formed from union of the swollen petioles of an abortive flower bud. The false fruits were up to 6 cm. in length and 4·5 cm. in breadth; they ripen about a fortnight later than the normal fruits, from which they do not differ in flavour, but contain no seeds.
It is not yet known whether the phenomenon is of an hereditary or teratological nature.

764. *Rybin, V. A. 634.22:576.16:575.127.2
(**Hybrids between the blackthorn and cherry plum and the problem of the origin of the cultivated plum**).
Bull. Appl. Bot. Leningrad 1936 : Ser. II (10) : Pp. 44.
Evidence is presented to shew that the domestic plums, represented by *Prunus domestica* and *P. insititia*, do not occur in the wild state. This supports the hypothesis of Darlington and others that it arose as an amphidiploid from the hybrid between *P. divaricata* Ledeb.,

* An extended summary of this paper is on file at the Bureau.

(*P. cerasifera* Ehrh.) with 16 somatic chromosomes and *P. spinosa* with 32, and other evidence is also quoted. In order to put the hypothesis to the practical test, crosses were carried out between these species, both of which proved highly polymorphic, and the results are described. Using *P. spinosa* as the maternal parent an average set of 6·4 per cent was obtained and 2·9 per cent in the reciprocal cross. Certain natural hybrids between the two species were also found in Transcaucasia.

The hybrids were mainly intermediate between the parental species and in consequence shewed a great resemblance in many respects to the domestic plum. They were largely sterile, however, bearing on the average only about half a dozen fruits each. The different hybrids varied in their morphological characters and also in the characters of the fruit, some approximating more to one parental species, some to the other. These differences were evidently the result of differences between the parental forms entering into the cross.

All the hybrids with one exception have 24 chromosomes in their root tips. The exception was one of the reciprocal hybrids, *P. divaricata* x *P. spinosa*, which proved to have 2n = 48. It is, therefore, an amphidiploid, thought to have arisen by the union of two unreduced gametes. It differed from the other hybrids in certain respects, notably by its greater size and vigour. It is remarkably similar to the domestic plums and its formation throws light on the probable origin of this group.

765. Pirovano, A. 634.25:575.12:538
Miglioramento genetico del pesco. (**The genetical improvement of the peach**).
Ital. Agric. 1936 : **73** : 711–22.

Brief descriptions of a number of the progenies from crosses between American and of American with Italian varieties are given.

The pollen was treated by the electro-magnetic method of the author.

CITRUS FRUITS 634.3

766. (1) Tanaka, T. 634.3:576.16:575.32
(**Studies in the origin of citrus flora of various localities**).
Proc. Jap. Ass. Adv. Sci. 1935 : **10** : 570–76.

(2) Tanaka, T.
(**The characteristics of the tropical citrus flora**).
Agric. and Hort. Japan 1934 : **9** : 2343–56.

(3) Tanaka, T.
(**Hunting for the citrological treasures, an inquiry into the mystery of citrus fruits of India**).
Hort. Trop. Japan 1935 : **5** : 42–62.

(4) Tanaka, T.
(**History of dispute in the citrus classification**).
Studia Citrol. 1935 : **7** : 1–39.

The first paper is a contribution to the study of the distribution and origin of the genera and species of citrus fruits, including the genera *Citrus*, *Poncirus* and *Fortunella*, in China, Japan, India and Europe.

In the second paper the subject is treated from the standpoint of adaptation to climatic influences. Diagnoses of certain unfamiliar species are given.

The third paper deals with the systematic classification of citrus fruits with special reference to the types described by Bonavia.

In the fourth paper the defects of the attempts that have hitherto been made to classify the citrus flora are described at some length as a preliminary to a statement of the author's views on the necessity for studying the local forms of various localities, as well as closely related wild species from living material. The list of *Citrus* species must be extended. Seventy-four species are enumerated and progress is being made with the work on the species from various districts.

A bibliography of 85 references is appended.

767. NAKAMURA, M. 634.3:576.356.5:581.162.5
A preliminary report on the chromosome number, pollen sterility, and the formation of abnormal pollen tetrads in *Citrus*.
Bull. Kagoshima Coll. Agric. For. 1934 : **1** : 11–14.
The haploid chromosome number was determined from the pollen mother cells in a wide range of material representing some 33 species of *Citrus*. Only in *C. microcarpa* was a tetraploid found, the form Shikinarimikan, with n = 18, all the remaining forms having nine bivalents. Most of the varieties of lime, lemon and sweet orange formed abnormal tetrads, usually with more than four, but occasionally in lemons with less than four grains. In most varieties of Navel oranges, two varieties of sour orange and the Tahiti lime, the pollen mother cells degenerate in an early stage of development. High percentages of sterile pollen were observed in certain lemons, sweet oranges, sour oranges and loose-skinned oranges. The tetraploid Shikinarimikan also shewed pollen sterility to an extent of about 40 per cent. In several lemons the percentage of sterility was less in April than in February or March.
Further studies are in progress.

768. SHAMEL, A. D. and POMEROY, C. S. 634.31:575.25
An inherent unstable strain of the Valencia orange.
Calif. Citrogr. 1936 : 153, 186–87.
A study was made of the bud variations of 4,911 trees in an orchard planted with the Hart's Tardiff strain of the Valencia orange. In all, 692 trees were found to carry variant fruits or foliage, indicating that Hart's Tardiff is an inherently unstable strain. It is believed that this instability can be reduced, if not eliminated, by systematic bud selection.
A not uncommon variant involved the production of navel oranges, and in view of their economic advantages, such as relative freedom from seeds, larger size, more attractive eating quality, more suitable shape for packing and tendency to hold on the trees unusually well, efforts are being made to propagate a strain producing such fruits.

769. BENEMERITO, A. N. 634.31:581.163(51)
The occurrence of navel oranges in Kwangtung Province.
Lingnan Sci. J. 1936 : **15** : 471–76.
The sporadic occurrence of Navel oranges is a not uncommon feature of citrus orchards in Kwantung Province. Descriptions are given of three such forms of *Citrus sinensis* Osbeck, Chi Chang or Luntau Navel Orange, Hushuae Orange and Hoichow Navel Orange. Seeds are few in the fruits of the first two, but Hoichow Navel sometimes has many seeds.
All three are being propagated vegetatively to see whether the variation can be transmitted by this means.
Navel forms have also been observed in the Mandarin orange (*Citrus nobilis* Lour.).

770. JARRY-DESLOGES, R. 634.322 Clementine
Les Clémentines. (**Clementines**).
Rev. Hort., Paris 1936 : **108** : 322–23.
This is a kind of mandarin and thought to have originated from a cross between a mandarin and a variety of Bigaradier, the Granito. Such hybrid mandarins, called tangerines but of different parentage also have long been known under various names such as the Dancy of United States of America and the satsuma of Japan, etc. The Clementine itself shews a number of forms, some of which are described.

771. 634.322:575(79·4)
FROST, H. B. 634.31:575(79.4)
New citrus varieties for trial.
Univ. Calif. Citrus Exp. Sta., Riverside September 10th, 1935 : Pp. 2. (Mimeographed).
A brief account of the Trovita orange and the Kara, Kinnow and Wilking mandarins, more fully described in the bulletin reviewed in "Plant Breeding Abstracts", Vol. VI, Abst. 1382.

VARIOUS SMALL FRUITS 634.4

772. 634.418:576.35:581.331.2
LOCKE, J. F. 634.418:576.312.35
Microsporogenesis and cytokinesis in *Asimina triloba*. Contributions from the Hull Botanical Laboratory 474.
Bot. Gaz. 1936 : **98** : 159–68.

A study of meiosis of *Asimina triloba* (L) Dunal, in which special emphasis is laid on the peculiar type of cytokinesis observed in the divisions of the pollen mother cells in forming microspores, is presented.

Chromosome counts indicated that 9 was probably the haploid number.

Cytokinesis of the pollen mother cells is by successive constriction phases accompanied in some cells by the formation of an inconspicuous and evanescent cell plate in the first division but not at the second division. As a rule the first cytoplasmic division is completed before the second nuclear divisions take place.

NUTS 634.5

773. FERNALD, M. L. 634.54:575.12
A smooth-husked hazel.
Rhodora 1936 : **38** : p. 76.

A form of the Beaked Hazel, *Corylus cornuta* Marsh. (*C. rostrata* Ait.), has been discovered with essentially glabrous involucres. It is thought that a cross between the new form (for which the name *C. cornuta* Marsh. forma *inermis* is suggested) and the filbert might yield a good type for northern latitudes.

774. 634.55
EVREINOFF, V.-A. 634.551:581.6:575.1
Notes sur la biologie de l'amandier. (**Notes on the biology of the almond tree**).
Rev. Hort. Paris 1936 : **108** : 267–68.

In addition to comments on flowering, pollination, genetic sterility and the hybridity of varieties in the almond (*Amygdalus* sp.) the work of Heppner on segregation of both sweet and bitter types from crosses of sweet varieties is cited. He found the bitter character was recessive to the sweet.

775. HUSTED, L. 634.58:576.312:576.16
Cytological studies on the peanut, *Arachis*. II. Chromosome number, morphology and behavior, and their application to the problem of the origin of the cultivated forms.
Cytologia, Tokyo 1936 : **7** : 396–423.

Continuing the investigation recorded in "Plant Breeding Abstracts", Vol. IV, Abst. 772 a review of the cytological literature is given with observations on the number and morphology of the chromosomes and their behaviour at meiosis and at the first mitosis in the pollen grain in species and varieties of *Arachis*. The cytology of an aneuploid form and of a number of F_1 hybrids from a Spanish x Runner cross was also studied.

A. hypogaea appears to be a polyploid species. The chromosome number of 31 species, varieties, lines and hybrids (comprising 116 plants in all) was 20 haploid or 40 diploid except in one plant which had 41 chromosomes and a fragment in the somatic tissue. Morphologically the Red Spanish (bunch) type and the Runner type examined are apparently nearly identical as regards their chromosomes and both possess two anomalous *A* and *B* pairs of chromosomes, the second of which (*B*) is here described for the first time. Discussing the origin of the bunch and runner forms of the commercial peanut, the author concludes that both these forms and *A. nambyquarae* and *A. Rasteiro* have a common origin.

776. BARRETT, C. 634.653:575(79.4)
What the Variety Committee is seeking to do.
Yearb. Calif. Avocado Ass. 1935 : p. 27.

BARRETT, C.
Report of the Variety Committee of the California Avocado Association—1935.
Yearb. Calif. Avocado Ass. 1935 : 28–33.

With the object of finding a form with the distinctive characteristics of the Fuerte avocado variety, but with more consistent bearing, the Committee is examining seedlings from this variety submitted to it by growers. The Fuerte variety is quite distinct from avocados grown in the West Indies and elsewhere in the U.S.A. and is characteristic of Californian avocados.

777. 634.653:575.255
HODGSON, R. W. 634.653:575.247
Avocado fruit abnormalities.
Yearb. Calif. Avocado Ass. 1935 : p. 109.

A few abnormalities such as striping of the fruits and variegation of the leaves are mentioned and ascribed to somatic mutation.

778. POPENOE, W. 634.653:576.1:581.9
Origin of the cultivated races of avocados.
Yearb. Calif. Avocado Ass. 1935 : 184–94.

The cultivated avocados are all considered by the author to be horticultural forms of *Persea americana* Miller (*P. gratissima* Gaertn.). A form described by Mez as *P. gratissima schiedeana* is a distinct species *P. sciedeana* Nees and not a true avocado. The cultivated races are the Mexican, the Guatemalan and the West Indian or South American. The anise-scented, small-fruited, thin-skinned avocados known as the Mexican race are probably derived from the wild avocado of Orizaba, Vera Cruz. The wild avocado of Tecpan, found at a height of 8,000–9,000 feet in the mountains between Tecpan and Solola is almost certainly the prototype of the thick-skinned, non-anise-scented, hardy Guatemalan race.

The wild avocado of San Isidro, found from Honduras at least as far south as Costa Rica may be the ancestor of the West Indian race, as its geographical distribution suggests, but if so, it has changed considerably in cultivation, having, in particular, lost its anise-like odour. In the region of Santa Marta, Colombia, on the slopes of the Sierra Nevada, avocados closely resembling the West Indian race grow in profusion in an apparently wild state. If these are truly indigenous they are undoubtedly the prototype of the West Indian race, but the possibility cannot be excluded that they are escapes.

779. TORRES, J. P. 634.653:581.162:575.12
Some notes on avocado flower.
Philipp. J. Agric. 1936 : 7 : 207–27.

Avocado varieties may be divided into two groups according to their floral behaviour. In Group A, to which belong Baldwin, Commodore, Vega and Wester, the first opening of flowers takes place in the morning when the stigmas are receptive, while dehiscence of the anthers takes place on the afternoon of the following day. In Group B, including Cardinal, Cyrus, Miami, P.I. No. 4857, Pollock, Lyon and Tertoh, the first opening occurs in the afternoon, dehiscence following the next morning. In Wester and Pollock there was considerable overlapping of the periods of opening of the morning and afternoon flowers.

The technique of hybridization is described. The excess flowers on the racemes should be removed two to three days before the opening of the flowers to be crossed. Emasculation and cross-pollination should be performed on the first opening of the flower.

The success of crosses varied considerably; some varietal crosses are successful in either direction, some only in one and some in neither. Some varieties are self-fruitful, some only partly so and some self-sterile. It is suggested that in selecting seedling varieties most attention should be paid to self-fruitful forms, these being most valuable for commercial plantations.

780. 634.711.3 Marcy
SLATE, G. L. 634.711.3 Indian Summer
Two excellent new red raspberries.
Horticulture 1936 : **14** : p. 364.
Brief descriptions are given of Marcy, the largest red raspberry now available for planting, and Indian Summer, an autumn fruiting raspberry.

781. LILIENFELD, F. A. 634.75:575.127.2:576.356.5
Karyologische und genetische Studien an *Fragaria* II. Ist *Fragaria elatior* eine autopolyploide Pflanze: (**Karyological and genetic studies on *Fragaria* II. Is *Fragaria elatior* an autopolyploid plant?**)
Jap. J. Bot. 1936 : **8** : 119–49.
In the introduction the exact nature of auto- and allopolyploidy is discussed and it is pointed out that in autopolyploids the different genoms are homologous but not necessarily identical. There exist therefore transition forms between autopolyploids and allopolyploids. It follows also that a plant may be more auto- than allopolyploid and yet have regular chromosome pairing, for competition in pairing will probably favour conjugation between chromosomes of more nearly identical genoms.
The meiotic behaviour of the tetraploid (2n = 28) hybrid [*F. elatior* (2n = 42) x *F. nipponica* (2n = 14)] is described (Cf. "Plant Breeding Abstracts", Vol. IV, Abst. 254). This, together with the fertility of the hybrid and the constancy of the chromosome number in succeeding generations shews clearly that two of the *elatior* genoms, $E_{(1)}$ and $E_{(2)}$ are homologous, while the third, $V_{el.}$ is homologous with the *nipponica* genom $V_{nip.}$ The genom formula of the F_1 is therefore $V_{nip.}$ $V_{el.}$ $E_{(1)}$ $E_{(2)}$ and of the succeeding generations, which the author accords specific rank under the name *F. elnipponica*, V_R V_R $E_{(R)}$ $E_{(R)}$, the suffix R denoting that the genom has arisen by recombination.
The spontaneous appearance of a female hexaploid plant in the F_2 of the above cross afforded an opportunity of investigating the relation between the V and E genoms. The hexaploid, having arisen from the union of a reduced and an unreduced gamete, has the genom formula $V_{nip.}$ $V_{el.}$ V_R $E_{(1)}$ $E_{(2)}$ $E_{(R)}$. Meiosis in the hexaploid was fairly regular, 20 bivalents being usually formed, with two or sometimes one univalent and occasionally one or two tetravalents. Fertility was fairly good, much better than in pentaploid hybrids with an unpaired E genom, and in back-crosses with *F. elatior* and *F. nipponica* the chromosome numbers of the progeny were quite constant, 42 and 28 respectively. These three different types of evidence all point to the same conclusion, that the V and E genoms are homologous. It follows therefore that *F. elatior* is an autohexaploid and that *F. elnipponica* is an autotetraploid.

782. YAMAMOTO, Y. 634.752:577.8:581.04
(On the effect of calcium chlorate on the dioecious plants).
Jap. J. Genet. 1936 : **12** : 73–80.
Differential reactions to solutions of $KClO_3$ were observed in male, female and intersex plants of *Rumex acetosa*, *Aucuba japonica* and *Fragaria elatior* and a tetraploid hybrid of the latter with *F. nipponica*.
In contrast to the results obtained with *Rumex* and *Aucuba*, in *Fragaria elatior* and in the tetraploid the male plants suffered much more injury than the female plants; and since in *Fragaria* the female sex is heterogametic it might possibly be that the differential reaction to $KClO_3$ may be determined, not by the actual sex, but by the homo- or heterogametic condition as the case may be. Admittedly, however, this generalization would be difficult to confirm.

783. 634.771:576.16:575.247

CHEVALIER, A. 634.771:575.12

Les variétés de bananiers du groupe *Cavendishii*. Leur genèse par mutations végétatives. L'avenir de l'hybridation. (**The varieties of bananas of the *Cavendishii* group. Their origin by vegetative mutation. The future of hybridization**).

Rev. Bot. Appl. 1935 : **15** : 573–80.

Cheesman's classification of the varieties constituting the Cavendish group is cited and in some cases compared with Kervegant's descriptions of the Cavendish variants. Notes are given on the author's inspection of the collection of aberrant forms in the Botanical Gardens at Teneriff. Evidence is available from various sources that bud mutations do occur in this species and will probably be found in other species too, and may indeed account for the large number of varieties that have been found in bananas. The value of such mutations as material for hybridization is indicated. The work of Cheesman and of Sutherland is cited.

784. COLLINS, J. L. 634.774:575.247

A frequently mutating gene in the pineapple *Ananas comosus* (L.) Merr.

Amer. Nat. 1936 : **70** : 467–76.

Whereas all known wild pineapples have spiny leaves, the variety cultivated in Hawaii, Smooth Cayenne, has only a few small spines on the edges near the tip and base. The difference is conditioned by a single main dominant factor *S* for smoothness, Smooth Cayenne being heterozygous. In fields of Smooth Cayenne (vegetatively propagated) and in heterozygous hybrids, occasional spiny plants or chimaeras occur, by somatic mutation from *Ss* to *ss*. The frequency of such chimaeras is greater in the hybrids than in commercial plantings of Smooth Cayenne and it is suggested that the difference may be due to mutations to *SS* having also occurred in Smooth Cayenne. In the homozygous clone 8,341 (*SS*) no such chimaeras occur, but in crosses of 8,341 with spiny forms, a proportion of spiny plants and chimaeras occur, suggesting that mutations from *S* to *s* does occur in 8,341, though the dominance of *S* prevents its being observed. The presence of *SS* plants in Smooth Cayenne is being tested by crosses of large numbers of plants to spiny varieties.

The average rate of mutation from smooth to spiny is given as 4·97 per cent.

VITICULTURE 634.8

785. 634.8(44)

CHUARD, E., PORCHET, F. and FAES, H. 634.1/2(44)

Cinquantenaire de la station viticole de Lausanne 1886–1936. (**Fifty years of the viticultural station of Lausanne 1886-1936**).

Lausanne 1936 : Pp. 83.

An account of the origin of the station, fifty years ago, its personnel and organization and the work that is being done not only on the growing of grapes but also on the making of wine. Pome and stone fruits also receive attention at this station.

FORESTRY 634.9

786. 634.97:581.142.03

JAPING, H. W. 634.97:581.48:575.42–181

Kiemingsonderzoek van zaden. (**Germination tests of seeds**).

Bergcultures 1935 : **9** : 8–21.

A physiological study of germination, mainly in forest trees, and how it is affected by various factors such as light, maturity, etc. The effects of selection for seed size, which is partly genetically conditioned, are also discussed.

787. Andersson, G. and Sylvén, N. 634.97–2.111–1.521.6:581.45
Om sambandet mellan höstfärgning resp. lövfällning och vinterhärdighet hos träd och buskar. (**On the relationship between autumn colouring or the fall of the leaves and winter-hardiness in trees and bushes**).
Svensk Bot. Tidskr. 1936 : **30** : 590–612.

Literature on the nature of winter-hardiness in ligneous plants is cited. Apparently within the species, trees displaying early loss of colour and early fall of the leaves suffered less injury as a result of cold than trees that retained their colour and leaves longer. Moreover the cold resistance behaviour in 17 out of 22 genera corresponded with that within the species.
There is a bibliography.

788. 634.972:575.242:581.44
Svoboda, P. 634.975:575.242:581.44
O systematické hodnotě kůry našich dřevin, zejména o kůře smrku a jejích mutacích. (**On the systematic value of the bark of our species of woody trees—especially the spruce and its mutations**).
Lésn. Prace (Forestry Practice) Písek 1936 : **15** : Pp. 21.

Since among the local races of woody trees forms differing in the time when growth starts or in the quality of the wood frequently occur in the same locality, the question of the possibility of distinguishing such forms by their morphological characteristics is examined in the light of previous literature on the subject.
A correlation between the type of bark and the wood is held to exist and the differences in bark are apparently, in part at least, genetically conditioned.
On the basis of the author's observations on differences in the bark of the *Picea* species in the Liptovské Hole region, a number of forms and mutations are identified and described.
The existence of similar mutations in the fir is mentioned.

789. 634.972:575.41:581.02
Schmidt, W. 634.972:576.16
The racial biology of forest trees.
Res. and Progr. Berlin 1935 : **1** : 131–36.

The pronounced influence of climate and environment in the natural selection of forest trees is emphasized. Attention is also drawn to the difficulty in artificial selection work of allowing for environmental reactions in species and in judging the hereditary characteristics of individual trees or species from their outward appearance. In order to obtain the necessary data for a study of the physiological characters which are hereditary and typical of the species, the Institute for the Testing of Forest Seeds has begun experiments on the reactions of various species to physiological stimuli such as light, seed fermentation, etc. Much more data must, however, be accumulated before individual types and their physiological and chemical reactions can be worked out. Work is also in progress on the identification and classification of seed of unknown origin sent by co-operating centres in North America and Stockholm.
Another kindred line of investigation is the study of the climatic effects of light and humidity as reflected in differences in the anatomical structure of the assimilative and transpiratory organs. Though this aspect of the problem has not yet been taken up, a study is now in progress regarding the possibility of differentiating average types in pines by the anatomical structure of their needles and thus determining the localities from which the trees came.

790. Wettstein-Westersheim, W. v. 634.972.1:581.162.31
Selbstbefruchtung bei Eiche. (**Self-pollination in oaks**).
Forstarchiv 1935 : **11** : 247–48.

Self-fertility is established by the author for *Quercus pedunculata* and is assumed for *Q. sessiliflora*.

791. 634.975:575.12
SCHWEPPENBURG, H. G. VON 634.975:582
Zur systematik der Gattung *Larix*. (**On the systematics of the genus *Larix***).
Mitt. dtsch. dendrol. Ges. 1935 : **47** : 1–7.
A new classification for *Larix* is suggested based on morphological, geographical and genetical grounds. As all larches are so closely related, hybrids between them should be common. This is the case with the sub-species *Gmelinii* x *olgensis*. Proof is lacking in the nearly related forms *Potaninii* x *Mastersiana* and *occidentalis* x *Lyalii* but the parental forms are so alike that it is impossible to distinguish the hybrids. The cross *Larix leptolepis* x *L. decidua* has produced a hybrid form named *euolepis* by Henry. It is also assumed that the so-called *L. pendula* is a hybrid between the German alpine larch and the American *laricina*.

792. GÖTZ. 634.975:575.4:634.956
Kiefernzüchtung und Naturverjüngung. (**Pine breeding and natural regeneration**).
Allg. Forst-u. Jagdztg. 1935 : **111** : 256–60.
The ideal type of pine is described. Not only in morphological characters but also in such physiological aspects as high seed production, resistance of the young trees to snow and shade, etc., improvement is desired. Genotypical mother trees of high quality must also be found. The possibilities of finding such forms in the artificial seed-bed where all types are allowed to develop is much less than under natural conditions where natural selection is constantly at work.

793. 634.975:576.16
SEITZ, D. 634.975:575.42
Die Kiefernrassenzucht in Theorie und Praxis. (**The production of races of Scots pine in theory and in practice**).
Mitt. Forstwirt. Forstwiss. 1936 : **7** : 121–26.
As an amplification of Behrndt's paper (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1409) the author presents his views on the forest development and the selection of races of conifers and other trees with special reference to pines (*Pinus*) and the origin of the well-known pine No. 16. Some additional notes are included on results obtained by individual selection, including freedom from leaf-fall disease and the general performance of various progenies.
Certain advantages found in hybrids between the superior races of pine with their outstanding qualities of growth and timber on the one hand and the type of the local variety on the other are mentioned, e.g. the ease with which such hybrids regenerate, and adaptability to various conditions.
Illustrations are offered as instructive examples of types from which races might suitably be reared.
The constancy of colour inheritance in the fir and the Acacia and the relation between bark characters and timber qualities in pines and other trees are touched upon with references to previous literature on the subject.
The importance of experience in recognizing racial differences and the author's part in selection and progeny testing work are also mentioned.

794. JASIEŃSKI, W. 634.975:576.16:578.087
Badania różnic w stosunkach strukturalnych i przyrostowych dwu różnych ras sosny pospolitej metodami biometrycznemi. (**Investigations on the structural and growth relations of two races of the common pine by means of biometrical methods**).
Acta Soc. Bot. Polon. 1934 : **11** : 329–83.
This paper begins with a discussion of the concept of races and the nature of their origin with reference to Johannsen and the modern theories on the origin of racial characters by gene changes or hybridization.

The necessity for determining racial characters by statistical methods is emphasized and the process of identification of two particular stands of pine (*Pinus* species) in Poland as belonging to separate races is described.

795. Flory, W. S. 634.975:576.312.35:576.16
Chromosome numbers and phylogeny in the Gymnosperms.
J. Arnold Arbor. 1936 : **17** : 83–89.

Chromosome counts were made on certain species of the *Araucarineae* and *Podocarpineae*. *Agathis robusta*, *Araucaria brasiliana* and *Araucaria Cunninghamii* all contained 13 chromosome pairs. The nature of the chromosomes is described.
A form ascribed to *Podocarpus falcatus* had 24 chromosomes, *P. macrophyllus* about 38–40, which was also the figure observed in *P. neriifolius*, *P. chinensis* and *P. andinus*.
On the basis of the chromosome numbers, which are now known for all the main members, a proposed phylogenetic arrangement of the Gymnosperms is presented, the basic chromosome numbers being 8 or 9 for the *Cycadales*, 7 for the *Gnetales* and 12 for the *Ginkgoales* and *Coniferales*. The podocarps with about 38 are, it is suggested, triploids with the basic number 12 or 13, which latter is also the basic number for the *Araucarineae*.
The chromosomal classification of the group accords fairly well with the morphological classification.

796. 634.975:581.056
Rubner, K. 634.975:575"793"
Beitrag zur Kenntnis der Fichtenformen und Fichtenrassen. (**A contribution to the study of the forms and races of the Norway spruce**).
Thar. Forstl. Jahrb. 1936 : **87** : 101–76.

In Part I of this paper attention is drawn to the difficulty of identifying the distinctive characteristics of crown and trunk owing to the large number of variations that occur in these two features and the various type of crown and the racial differences found at certain altitudes in different regions in Europe are described, exemplified by numerous photographs. The types of branching are also noted.
In part II the value of the various forms of the Norway spruce in the Mittelgebirge is examined, rapidity of growth and the effects of injury due to climate, especially the effect of late frosts on young trees, being taken as the criteria.
In an experiment with seed from green and red coned mother trees no correlation was observed between cone colour and the time when the young branches began to appear.

797. Busse, J. 634.975:581.162.31:575.42
Forstliches Artgesetz und Forstpflanzenzüchtung. (**Legislation relating to forest species and forest tree breeding**).
Silva 1935 : **23** : 337–40.

A law ordering the eradication of all inferior types of stands and of individual trees leads to a discussion of how these arise.
Examples are given shewing the deterious effect of foreign pollen on pine trees.
The selection of homozygous strains is therefore advocated as one of the first duties of the forester, who should continue by selection to produce the best possible strains.

VEGETABLES 635

798. Davidovič. 635.24:575.127.2:633.854.78
(Hybridization in the Jerusalem artichoke).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 85–88.

Since the existing Jerusalem artichoke varieties display great lack of variation and are deficient in a great number of features, distant hybridization is being practised. The artichokes were induced to flower earlier by curtailing the length of day, whereby it was possible to cross them with the sunflower and the wild species *Helianthus rigidus*. Pollination was effected with a feather without previous emasculation. The hybrids flowered earlier than *H. tuberosus*. At

least one promising hybrid with the sunflower, having large regular tubers on short stolons, was obtained.
Crosses were also made between *H. rigidus* and the sunflower, on some of which hybrids small tubers were formed.

799. WINTER, L. 635.24:575.257
Étude pratique des variétés de topinambour obtenues par le professeur Lucien Daniel. (**Practical studies on the varieties of artichoke obtained by Professor Lucien Daniel**).
Rev. Hort. Paris 1936 : **108** : 352–56.
Three forms of Jerusalem artichoke, *Helianthus tuberosus*, grown from seed obtained from the artichoke grafted on to the sunflower and producing edible tubers are described. The tubers have the advantage of being comparatively smooth and therefore more easily prepared for cooking than the original variety.
An account is given of other forms whose flowers make them suitable for ornamental horticulture.

800. LEVAN, A. 635.26:576.356.5
Zytologische Studien an *Allium Schoenoprasum*. (**Cytological studies on *A. Schoenoprasum***).
Hereditas, Lund. 1936 : **22** : 1–128.
The examination of a large number of forms of *A. Schoenoprasum* shewed that three morphological types could be distinguished, namely, the diploid which itself consists of a very large number of biotypes, and is known by the length of its pollen grains (28–30) ; the autotetraploid, a well differentiated type, with pollen grains of 36–40μ in length and the allotetraploid which differs from all other *Schoenoprasum* forms in several characters and has pollen grains of 36–37μ.
Only crosses of tetraploid x diploid were successful. The F_1 is triploid, intermediate in many characters but more like the tetraploid parent and self-sterile.
The F_2 was obtained by open pollination and shewed, as was expected, a great variety of forms. The chromosome number varies from 16–45 with 60 per cent of the total progeny in the 29–31 class.
Meiosis was studied in detail in the diploid, the triploid, the autotetraploid and the allotetraploid. The formation of giant pollen grains with the double chromosome number occurs with considerable frequency in *Allium* and is the result of the suppression of the second division.
Treatment of the flowers during reduction division by X-rays produced very marked irregularities leading to the formation of very abnormal pollen grains.
As there is no evidence for a somatic doubling of the chromosomes to account for the origin of the tetraploid forms, it is concluded that the doubling most probably occurs in the gametes.

801. FEDORINTSCHIK, N. 635.34–2.411.1–1.521.6
(**Investigation on the determination of the injuriousness of the *Plasmodiophora brassicae* and development of immune varieties of cabbage**).
Plant Protection, Leningrad 1935 : No. 2 : 87–95.
Observations on plants suffering different degrees of attack shewed that the damage produced by a given degree of infection was the same for all varieties. The actual attack in different varieties grown under the same conditions, however, varied greatly. Of fifteen varieties examined, five proved to be highly resistant and four highly susceptible, the latter group having an infection of 43·9 per cent as compared with 11·4 per cent in the former.

802. GRANER, E. A. 635.46:576.312.35
O numero de chromosomios em "*Portulaca oleracea*". (**The chromosome number in *P. oleracea***).
Rodriguésia, Rio de J. 1936 : **2** : 158–59.
The somatic number 54 was determined in root tips.

803. LESAGE, P. 635.563:575.31"793"
Une vue d'ensemble de 10 années de cultures sur la précocité acquise et héritée. (A general view of 10 years of cultivation on earliness acquired and inherited.)
C.R. Acad. Sci. Paris 1936 : **203** : 625–27.
A brief review of the author's results on the inheritance of the acquired character earliness, in *Lepidium sativum*.
The earliness acquired by three generations of cultivation in Algiers is inherited up to the seventh generation when grown at Rennes. Plants have also been grown at Marseilles and at Rothamsted for one generation.

804. PANGALO, K. I. 635.61/3:577.8:576.12
On the diversity of sex expression in plants as illustrated by the *Cucurbitaceae*.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1936 : III (XII) No. 2 (97) : 77–81.
Forms with hermaphrodite flowers and superior ovaries have been shewn to be of frequent occurrence in *Cucumis* and in certain other genera of the *Cucurbitaceae* and forms intermediate between this and the normal type also occur. These forms are regarded as representing stages in the evolution of the cucurbitaceous flower from an original hermaphrodite to monoecism and dioecism. Other intermediate types in the supposed evolutionary series have been found amongst hybrids. Some have flowers with inferior and others with superior ovary, thus increasing the number of possible floral types to fifteen.

805. PANGALO, K. I. 635.61/3:577.8:576.12:575.113
On genes determining different sex types in plants as illustrated by the *Cucurbitaceae*.
C.R. (Doklady) Acad. Sci. U.R.S.S. 1936 : III (XII) No. 2 (97) : 83–85.
Of the fifteen possible floral types referred to in an earlier article (see Abst. 804 above) only six have been found naturally occurring. In a cross between a diclinous monoecious plant of *Cucumis flexuosis* and a typical androecious (all ♂) plant of *C. chinensis* however, all but two of the possible fifteen types were obtained in the F_2 and these two appeared in the progeny of another cross. The progeny of the pure male crossed by the pure female plants segregated into a variety of forms, shewing that dioecism is a complex character and has in the course of evolution evidently developed gradually, probably by an accumulation of genes as a result of natural selection. At least ten genes influencing flower type have already been identified and it is probable that more than this will ultimately be shewn to exist.

806. 635.615–2.484–1.521.6:575.11
BENNETT, L. S. 635.615:576.312.35
Studies on the inheritance of resistance to wilt (*Fusarium niveum*) in watermelon.
J. Agric. Res. 1936 : **53** : 295–306.
The extended account of the work already reviewed in "Plant Breeding Abstracts", Vol. VI, Abst. 1035.

807. SINNOTT, E. W. 635.62:581.48:575.11–181.12
A developmental analysis of inherited shape differences in Cucurbit fruits.
Amer. Nat. 1936 : **70** : 245–54.
Four different methods of genotypic control of fruit shape in Cucurbits are described, three affecting the shape index (length/width) and one affecting the pattern.
The relative growth of length and width may be expressed according to the equation $y = bx^k$, where y = length, x = width and b and k are constants. Differences in fruit shape between lines may be due to different values of b, in which case the difference will be constant throughout development. Such a case has been observed in *Cucurbita Pepo*, giving 3 : 1 segregation. Or

the difference may be due to different values of k, which may vary in Cucurbits from 0·8 to 2·2; in this case the difference is not constant throughout development. Thirdly a difference in shape may be occasioned as a result of the different sizes of the respective fruits at maturity, for according to the logarithmic relation given above the shape index varies according to the size.

Differences in pattern cannot be expressed simply in terms of shape index, for they depend not only on the relation between maximum length and maximum width but also on where the maximum width occurs. Monofactorial segregation for pattern type was observed in a cross between races having pyriform and inverted pyriform fruits respectively, though it was complicated by the independent segregation of factors determining index level.

Developmentally, these differences in shape are the result of different relative numbers of cells along different axes rather than to differences in cell shape.

808. 635.64(43)

NICOLAISEN, N. 635.64:575(43)

Studien am deutschen Tomatensortiment als Grundlage für eine Sortenbereinigung. (**Studies on the existing collection of tomatoes in Germany, as a basis for the production of pure varieties**).

Kühn-Arch. 1936 : **42** : 113–83.

Investigations on a very large number of varieties of tomatoes extending over 6 years were made in the interests of the grower, the trade and the seed producer. Observations were taken on morphological and economic characteristics including resistance to disease and pressure, flavour, behaviour during storage, preserving, etc., earliness, yield, synonymity, varietal status, etc. Special attention was paid to the fruit characteristics, which are exemplified by some of the numerous photographs in the paper.

Two experiments were made to test the occurrence of cross-pollination. The first gave a definitely negative result while the second shewed that cross-pollination had occurred—presumably by the agency of insects. The relative efficiency of self pollen as compared with foreign pollen was tested in reciprocal crosses and from the fact that the seed generation shewed all the features of the parent it is concluded that self-pollination must have occurred before artificial pollination was carried out when the flowers opened.

A tabulated survey of the results for all the varieties grouped under 7 types established in the investigation and the value of the results are considered from the practical standpoint, including that of seed certification. The necessity for improvement of tomato varieties by breeding and the various requirements and the problems which the breeders could aim at solving are stated in a brief concluding section.

There is a bibliography of 49 references.

809. OKA, T. H. 635.64:576.356.5

[**The progeny of tetraploid tomatoes. (Preliminary note)**].

Jap. J. Genet. 1936 : **12** : 89–92.

Forty heteroploid tomato plants, obtained from the seeds of tetraploids produced by decapitation, were remarkable for their slow germination, abnormal cotyledons, dwarfing and bushy habit. They set scarcely any or no seed. Somatic chromosome numbers of 49, 50, 51, 52, 53 and 54 were found among the plants so far examined and are thought to be possibly the result of irregularities in the division of the pollen mother cells in the tetraploids.

810. 635.646:581.162.31:581.163

YASUDA, S. 635.63:581.162.31:581.163

[**Some contributions on the parthenocarpy caused by the stimulation of pollination. (A report of the parthenocarpy caused by self-pollination in egg plants and cucumbers, with some additional discussions**)].

Bult. Sci. Fak. Terk. Kjušu Univ. 1936 : **7** : 34–55.

The effects of self-pollination, as distinct from cross-pollination (Cf. "Plant Breeding Abstracts", Vol. IV, Abst. 1117) were studied in the egg plant and the cucumber. The technique

is described. From these results and from previous experiments it is concluded that the pollen grains or the pollen tubes produce chemical substances which stimulate the pistils to produce parthenocarpic fruits. The question of whether such substances are produced under normal conditions or only when the fertilizing action of the pollen has been prevented is now being studied.
The possibility of parthenocarpy, phenospermy and parthenogenesis being due to the action of one and the same stimulatory substance is suggested.
A bibliography is added.

811. 635.65
LUDEWIG, K. and Voss, J. 633.3
Morphologische Sortenstudien an Erbsen, Ackerbohnen und Lupinen. (**Morphological varietal studies on peas, field beans and lupins**).
Angew. Bot. 1936 : **18** : 263–337.
Descriptions are given of a large number of varieties of each of the three crops, with indications of the breeding firms, etc., from which they have originated.

812. FRETS, G. P. 635.652:575.11–18
Hereditary variability in the F_3 seed generation after cross-fertilization of bean races.
Proc. Kon. Akad. Wet., Amsterdam 1936 : **39** : 432–40.
The average length, breadth, thickness, weight and length-breadth, length-thickness and breadth-thickness indices of individual plants of each of two pure lines of beans were measured and curves shewing graphically the relation of these dimensions to each other and to the average of the two lines were plotted. The curves were very similar in form within a line, but there were clearly marked differences between the two lines.
Similar curves were constructed for the seeds on individual F_2 plants (F_3 seed generation) and it was found that when the length of seed approximated to that of line I the form of the curve also tended to resemble that of line I and similarly when the length approximated to line II the curve tended to resemble the line II curve. This is considered to indicate that the dimensions are not inherited independently.

813. DANIEL, L. 635.652:575.12
Sur un croisement fortuit de haricot. (**On a chance cross in the French bean**).
C.R. Acad. Sci. Paris 1935 : **201** : 997–1000.
The F_2 of the cross previously described (Cf. "Plant Breeding Abstracts", Vol. V, Abst. 1147) obtained by selfing seven individuals of the F_1 was sown in seven lots. The results were remarkable for their variety, for the absence of any maternal characters and for the appearance of characters quite other than those of the parental forms which had been selected for thirty years and are regarded as pure lines. The author considers this to be a case of non-mendelian inheritance.

814. MALINOWSKI, E. 635.652:575.127.2:575.125:581.143.26.035.1
Les phénomènes de l'heterosis et la réaction photopériodique chez *Phaseolus vulgaris* (L.) Savi [**The phenomena of heterosis and the photoperiodic reaction in *P. vulgaris* (L.) Savi.**]
C.R. Soc. Biol. Paris 1935 : **119** : 659–60.
The phenomenon of heterosis shewn in the F_1 of crosses between the varieties *Phaseolus vulgaris oblongus* and *Phaseolus vulgaris melleus* (Cf. "Plant Breeding Abstracts", Vol. IV, Abst. 815) is also apparent in the F_2 and is taken as an indication of the existence of several (probably four) co-operating factors.
Two populations are distinguished in the F_2. One, the largest, includes the parental forms and the other, the vigorous plants resembling the F_1. Besides differences in the size of the plants the populations are distinguished by the value of the correlation coefficient of certain

pairs of characters. Generally speaking this value is greater in the population of small plants. The author finds that there is a connexion between the heterosis shewn by the F_1 and F_2 plants and the photo-periodic reaction, as the size of the plants can be modified by shortening the length of day to 8–9 hours. Differences in this respect were found in the various genotypes of the same size.

The author holds that his theory of co-operating factors and that of Jones' dominant factors are probably not necessarily incompatible as explanations of heterosis.

815. WALKER, J. C. 635.652–2–1.521.6

Discussion of disease-free and disease-resistant beans.

Canning Age 1936 : **17** : 171–72, 178.

An account of the lines along which work on disease resistance of beans has developed in United States of America with special reference to the work on resistance to anthracnose, bacterial blight and mosaic. The origin and development of the Idaho and the Wisconsin Refugee varieties from the Stringless Green Refugee bean is outlined in considering mosaic resistance (Cf. "Plant Breeding Abstracts", Vol. VI, Absts. 302 and 667).

816. 635.652–2.8–1.521.6:575.11

PARKER, M. C. 635.652:575.182

Inheritance of resistance to the common mosaic virus in the bean.

J. Agric. Res. 1936 : **52** : 895–915.

The resistant varieties used were Michigan Robust, the only immune commercial variety of field beans, and Corbett Refugee, developed from a single plant selection of Stringless Green Refugee. The susceptible variety used was Stringless Green Refugee.

The F_1s from the cross Stringless Green Refugee x Michigan Robust were all susceptible, while from the reciprocal cross 82 per cent were resistant. This difference between the reciprocal crosses continued during the F_2 and F_3 generations, but decreased in magnitude. Moreover it was found that some resistant F_2 plants gave rise to both susceptible and resistant plants in F_3, while some susceptible F_2 plants gave resistant plants in F_3.

No satisfactory hypothesis can be advanced to explain these facts, but it is clear that cytoplasmic inheritance plays an important part. An ultimate nuclear control of resistance, however, is indicated by the convergence of the results from reciprocal crosses in the later generations.

Different results were obtained when Corbett Refugee was used as the resistant parent, for then the F_1 individuals were all resistant whichever way the cross was made. A difference between reciprocals became evident in F_2; from the cross Corbett Refugee x Stringless Green Refugee, 91 per cent of the F_2 plants were resistant, from the reciprocal only 79 per cent. These results cannot be completely explained on Mendelian lines but from its mode of origin it is possible that Corbett Refugee carries a dominant factor for resistance.

That the bases for resistance in the two resistant parents are different is shewn by the fact that in the F_2 of crosses between them susceptible plants appeared, 7 per cent when Corbett Refugee was the female parent and 9 per cent. from the reciprocal.

817. GARBER, R. J. 635.655:001.4

Kingwa soybeans.

Bull. W. Va Agric. Exp. Sta. 1936 : No. 273 : Pp. 4.

Contains the same information as the article reviewed in "Plant Breeding Abstracts", Vol. VII, Abst. 359.

818. KALTENBACH, D. and LEGROS, J. 635.655:575

Soya: Selection, classification of varieties, varieties cultivated in various countries.

Int. Rev. Agric. 1936 : **27** : T 117–49, T 165–89, T 216–33, T 281–97.

A wide survey based on bulletins published by Experiment Stations in the U.S.A. and on the replies received by the Bureau of Agricultural Science of the International Institute of Agriculture, Rome, to enquiries addressed to the organizations concerned in all parts of the world.

After preliminary chapters describing the plant itself, method of breeding and the classification of varieties, the remainder of the article deals with the varieties cultivated in the various countries in which the soya bean is grown or where attempts to introduce it have been made. Special attention is paid to work in the U.S.A. on this crop. Here the chief method of improvement has been extensive introduction followed by pure line selection. About 7,000 seed samples have been introduced. The use of artificial hybridization is mainly confined to genetic studies.

819. 635.655:575"793"

(Production of early forms from late parents).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 3 : p. 92.

From a cross between the soya beans Illini with a vegetation period of 151 days and Gundžulinskii with a period of 130 days a hybrid was obtained in the F_2 which ripened in 123 days and remained constant in this respect in succeeding generations. Hybrids maturing 10–20 days before the parents occurred also in other crosses and their occurrence is explained by the combination of forms delayed in different developmental stages.

820. 635.655:575.12:578.08

ORATOVSKII, M. 635.655:581.162

(The method and technique of crossing the soya bean).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 4/12 : 72–78.

The floral biology of the soya bean is described, together with the technique of emasculation and pollination. Following the methods recommended, the percentage set obtained in crosses made in different years varied from 10 per cent in the worst year to 51 per cent in the best ; a great number of pods, however, fall off before reaching maturity. Lack of moisture is a factor adversely affecting the success and in hot dry seasons it is advisable to water the plants before crossing.

821. 635.655:575.127.2:576.12

KARASAWA, K. 635.655:575.11

Crossing experiments with *Glycine soja* and *G. ussuriensis*.

Jap. J. Bot. 1936 : 8 : 113–18.

In the F_1 of a cross between the soya bean, *Glycine soja* Benth. and *G. ussuriensis* Regel. et Maack., 40 somatic chromosomes were found, as in the parents, and meiosis in the pollen mother cells was quite regular.

The appressed condition of the hairs in *G. ussuriensis* was dominant over the erect condition in the soya bean and in the F_2 monohybrid segregation was observed.

The F_1 had a long and twining stem as in *G. ussuriensis* and all the F_2 and F_3 plants had more or less twining stems. Leaf form, flowering time, pod size and seed size and weight were intermediate in the F_1 and exhibited the typical segregation of quantitative characters in succeeding generations. The segregation in seed coat colour was complicated. Flower colour was the same, purple, in both parents and in the F_1.

The fertility of the F_1 and its progeny was quite normal and the results are taken to shew that the soya bean might have been derived from *G. ussuriensis* by the accumulation of gene mutations, without chromosomal changes.

822. 635.656:575(47)

ŽOGOLEV, A. 635.656 Victoria Bunch

(New varieties of peas have been produced).

Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 3/11 : p. 73.

From a cross between Mandorf Victoria and Rudzinskii Bunch (with pods in a bunch all at the top of the plant), a new pea Victoria Bunch has been obtained, mid-early, with peas of the quality of Victoria but with the bunch habit, which is valuable for mechanical harvesting. Breeding work on the variety is being continued.

823. Čubar'jan, T. K. 635.657–2.482–1.521.6
(Breeding gram for immunity to *Ascochyta* and quality).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1936 : No. 6 : 48–58.

Selection was begun in 1935 for resistance to *Ascochyta*, cooking quality and protein content, all being features in which *Cicer arietinum* is inferior to other legumes. Tests of large numbers of forms of different origin shewed that resistant forms occur in the samples of the subspecies *intermedium* from the Volga basin, North Caucasus, Ukraine, and also Czechoslovakia, Latvia, Bulgaria, Lithuania; those from Italy, the Crimea and Transcaucasia were intermediate in resistance. Various lines combining resistance and high yield have been selected, but all have proved inferior in quality.

Cooking quality was determined by the length of boiling required for the seed to swell and burst the seed coat; for the best varieties this time equals 67 minutes, for the worst 187, the white-seeded forms being better than those with coloured seeds. Variation in boiling time occurred within many of the varieties, shewing it to be a clear racial character.

Great variation was also found in protein content, the best lines containing as much as 28·72 per cent, which is equal to the best varieties of peas; nine out of thirty-four varieties tested contained more than 25 per cent protein. Starch content also varied.

In order to obtain the desired combination of resistance and quality it will be necessary to make crosses between the different types.

824. 635.658:575.12:578.08
Pariškura, I. 635.658:581.162
(The technique of hybridizing lentils).
Selektsija i Semenovodstvo (Breeding and Seed Growing) 1935 : No. 4/12 : 78–80.

The best technique for pollinating lentils is described. Small flower buds, pollinated the same day or the day after emasculation, gave the best results, with a set of 78 per cent and early morning pollinations or those made on a dull day were the most successful. Experiments on pollen germination in a sugar-agar medium shewed that the pollen retained its viability for seven days when kept under room conditions.

BOOK REVIEWS

FISHER, R. A. 519.2
Statistical methods for research workers.
Oliver and Boyd, Edinburgh and London, 1936 : 6th Ed. 15s. 0d.
Pp. xiii + 339. 78 tables. 12 figs.

The appearance of a new edition of this very necessary manual for experimental workers is a welcome tribute to its usefulness. The author has followed his usual plan of inserting additions of new matter, the paragraphs being numbered by adding additional decimals, so that a reference by Section number will apply to any edition. The existing material is left unaltered, so that, contrary to what is stated on the title page, the book is enlarged but not revised as far as this edition is concerned.

A new test of homogeneity for data with hierarchical subdivisions is illustrated by an example on the number of recombinations found in 22 progenies of the garden pea (Rasmusson). This is wrongly referred to in the preface as Section 15.1, whereas it should be Ex. 15.1 of Section 22. Tests of significance in connexion with regression coefficients have been extended to give Working and Hotelling's formula for the sampling variance of any point on the fitted regression line. The fitting of polynomial regression curves by a simplified arithmetical process based on summation, applicable when the observations are at equal intervals, has been extended by the addition of a section dealing with cases in which not one, but a number of values are known corresponding to each value of the independent variate. If the frequencies are unequal we have a case of fitting to unequally weighted data, and the author carries us through the various steps of the calculation. No reference is made to Aitken, who worked out the method in 1933, which is a little surprising in view of the author's readiness to give credit in many other cases for formulae and methods due to other workers.

The well-known z table has been increased in size by 50 per cent by the adding of the 0·1 per cent level of significance. The calculations are due to W. E. Deming, whose name is spelt wrongly on the table, though given correctly in the preface. J. W.

TRELOAR, A. E. 519.24
An outline of biometric analysis.
Burgess Publishing Company, Minneapolis, Minn. 1936 : $3.10. Pp. 193.
13 figs. 4 tables.

GOULDEN, C. H.
Methods of statistical analysis.
Burgess Publishing Company, Minneapolis, Minn. 1936 : $3. Pp. ii + 165.
12 figs. 69 tables.

These two excellent laboratory manuals, which are deserving of the attention of all biological workers, are "mimeoprinted" from typed sheets on one side only (the left) of the page, leaving the other for students' notes. The format is therefore a little unusual, and indeed there are disadvantages in that the book does not open flat, and that the printing shews through on the back of the page. They do, however, provide a great deal of material which is supplementary to that contained in the ordinary text-book, while the abundance of worked examples shews that the needs of teacher and student alike have been kept in mind.

The first is a new and much enlarged edition of a book published last year. The main subjects that should be treated in a recognized course of general statistics, from frequency distributions to the study of correlations, find a place. Particularly useful is the last part, in which the distribution problems of "small sample" analysis are covered. A number of tables are incorporated.

Dr Goulden has also the needs of the biologist in mind, but with a bias towards the field experimenter. The book is a working manual, and contains all the main formulae and tests in the ordinary statistical course, with numerous examples. Analysis of variance and covariance and their applications are particularly good. While it can stand alone as a text-book, the

student's reading is intended to be supplemented by the references given with each chapter, and many who find Fisher's "Statistical Methods" difficult will welcome the algebraical and arithmetical amplifications that they will find here. Snedecor's table for significance of a ratio of covariance estimates is reproduced. J. W.

DUGGAR, B. M. (Editor). 537.5
Biological effects of radiation. Mechanism and measurement of radiation, applications in biology, photochemical reactions, effects of radiant energy on organisms and organic products.
Volumes I and II.
McGraw-Hill Book Company, Inc., New York and London, 1936 : 70s. 0d.
(Vol. I) Pp. x + 676. illus. (Vol. II) Pp. vii + 677–1343.

For some years work has been in progress in the U.S.A. on the effects of radiation on organisms, with the assistance of the Committee on Radiation in the Division of Biology and Agriculture, National Research Council. The book under review is described in the preface as a "by-product" of this activity.

It is in every sense of the word a co-operative work; the editor, B. M. Duggar, has had the assistance of six collaborating editors and the 43 chapters are written by different authors.

The first seven chapters, comprising some 300 pages, are in the main non-biological and provide a physical and chemical groundwork which will be most useful to biologists.

They include a chapter on statistical methods. The transition to the biological effects comes in the form of three chapters on the effects of radiation on proteins, on vitamins and on venoms, toxins and antibodies. The remainder of the book is devoted to a most varied selection of radiation effects on living organisms. There are five chapters dealing with the genetic effects, namely: "Induced chromosomal alterations in animals", by T. Dobzhansky; "Radiation and the study of mutations in animals", by J. Schultz; "Induced mutations in plants", by L. J. Stadler; "Induced chromosomal alterations" (in plants), by T. H. Goodspeed; "Induced chromosomal alterations in maize", by E. G. Anderson; the two chapters mentioned on animals are mainly concerned with *Drosophila*. There is also a chapter on photoperiodism, written by W. W. Garner.

In general the book is concerned with effects of theoretical rather than of economic significance. Even so its two volumes contain over 1,300 pages with scarcely a superfluous word and represent a monumental achievement.

JUST, G. 575
Die Vererbung. (**Heredity**).
Ferdinand Hirt, Breslau 1936 : RM.5.50. Pp. 188. 59 figs. 7 tables.

In this small volume the author has published the substance of his elementary lectures on heredity in the hope of interesting a wider circle in a subject of such vital importance.

Mendel's laws of inheritance, applied to plants, animals and man, are discussed and explained. The cytological basis of heredity is demonstrated and the results of the recent work on the chromosomes of the salivary glands of *Drosophila* are described.

Sex inheritance is briefly touched upon and the origin of new hereditary factors by mutation. The final chapter is devoted to eugenics and to the importance of a knowledge of heredity in the development of the race.

575/577
MAVOR, J. W. 58
General biology.
The Macmillan Company, New York 1936 : 17s. 0d. Pp. xxiii + 729. 416 figs.

Though there has been of recent years a veritable spate of textbooks of botany, elementary texts dealing with general biology are much rarer, in spite of certain advantages of such a unified treatment, as illustrated by the book under review.

The author has divided the subject matter into five parts. Part I, headed "The Nature of Life", deals with the science of biology, cells, protoplasm and the characteristics of life. Plant

life is described in Part II, which includes chapters on bacteria, other *Thallophyta*, *Bryophyta* and *Pteridophyta*, life cycles and anatomy of seed plants, plant physiology, the classification and evolution of plants (a very brief chapter, comparing the four great orders) and the economic importance of plants. Part III deals with the invertebrates and Part IV with the vertebrates, while in Part V we return to the general point of view. This part, which is perhaps the most interesting, includes chapters on embryology, the physical basis of heredity (chromosomes, meiosis and fertilization), heredity, adaptation, distribution and the balance of nature and five further chapters on evolutionary topics. The chapter on heredity, which is rather better written than the preceding one, contains a brief reference to plant breeding, in which, however, Professor Biffen's name is twice mis-spelt.

The compression of the whole science of biology into about 700 pages naturally means that the treatment is somewhat brief in places, even for an elementary book, but on the whole the author has been happy in his choice of omissions. With respect to the general balance between the plant and animal sides, one may fairly represent it by his allocation of two parts to the animals and one part to the plants.

575:633

Yearbook of agriculture.

Yearb. Agric. U.S. Dep. Agric. 1936 : $1.25 : Pp. 1189. illus.

The United States Yearbook of Agriculture for 1936 differs considerably in form from preceding issues, being largely devoted to a "survey of superior germ plasm" which occupies over 1,000 pages. The remainder of the book contains the Secretary's report to the President and a selection of the annual statistics; the complete annual statistics are to be published separately. The survey of superior germ plasm is a most ambitious project, dealing with plant and animal breeding in the United States and abroad. Introductory chapters giving a popular and brief account of genetics and breeding are followed by chapters dealing with the crops and animals concerned. The crops are wheat, barley, oats, rice, maize, sorghum, sugar cane, sugar beet, cotton, flax and tobacco. These chapters contain a wealth of material of interest to plant breeders. Though they are written as simply as possible in the hope that they will be understood by the public which the Yearbook normally reaches they are yet authoritative accounts of the breeding work by men who have first-hand experience of the respective crops. The American work is naturally most fully treated, being the most readily available, but work in other countries is by no means ignored. At the end of each chapter is a concentrated survey of stations, workers, varieties produced, methods used, aims, etc., which make the work most useful for reference. It is impossible to give a summary of the book in a short space, but it should be mentioned that the theoretical as well as the practical aspects are dealt with and that the treatment is up-to-date. The series will be continued in the 1937 Yearbook with articles on vegetables, fruits, forage plants and forest and nut trees.

Those who have co-operated to produce this book, the editor, the committee on genetics appointed by the Secretary of Agriculture (himself a plant breeder) and the authors of the different chapters, are to be congratulated on a notable achievement.

575:633(43)

Ackerbau und Pflanzenzüchtung. Vorträge der Pflanzenbautagung Weihenstephan 1936. (**Crop production and plant breeding. Papers read at the Meeting on Crop Production, Weihenstephan 1936**). Forschungsdienst 1936 : Sonderheft 3 : Pp. 139. (Verlag J. Neumann, Neudamm und Berlin).

This publication deals with plant problems under present day conditions in Germany. The papers that may be of interest to plant breeders are summarized below:—

Meyer, K. — *Entwicklung und Aufgaben des deutschen Ackerbaus.* (*Development and mission of German crop production*). (*pp. 7–18*).

An economic study in which the development of German crop production and the problems that now lie before it are considered, as well as their repercussions in determining the trend in plant breeding.

Krohn, H. — *Tagesfragen der Pflanzenzüchtung.* (*Questions of the day pertaining to plant breeding*). (*pp. 18–22.*)

The good results that have followed the reorganization of Seed Control in Germany by the Decree of March, 1934 and the necessity of maintaining the standard and supply of pedigree seed are referred to in connexion with the campaign to increase crop production. The aims to be pursued by plant breeders are stated for the various crops and include high yield, protein content, winter-hardiness and disease resistance in cereals and potatoes, resistance to pests and virus diseases and high yield in beets. The breeding of fodder plants should be organized and developed, while as regards horticultural plants standardization by the elimination of undesirable varieties forms part of the programme. In vines research on resistance to diseases and pests is to be combined with investigations on earliness and hardiness.
The economic background of this programme is kept in mind.

Nieweg. — *Erfahrungen und Anregungen aus der Anerkennungspraxis.* (*Suggestions based on the results of experience in seed certification*). (*pp. 22–27*).

The importance of providing the best possible seed and varieties of proved value for all engaged in crop production in Germany is emphasized, with suggestions on the organization of the more general aspects of seed certification under existing conditions.

Hergenröder. — *Ackerbauliche Voraussetzungen für pflanzenzüchterische Tätigkeit in Süddeutschland.* (*Agronomic requirements in regard to plant breeding in southern Germany*). (*pp. 27–34*).

Attention is drawn to the close relationship existing between plants and the characteristics of the locality in which they grow and to the necessity for taking fully into account such factors as soil, locality and climate in any attempt at crop improvement. The many problems of adaptation that must arise in breeding economic plants suitable for the various regions of Germany are touched upon in an outline of the position in that country, as regards cereals, fodder and other crops and disease resistance investigations.

Scharnagel. — *Stand und Aufgaben der Pflanzenzüchtung im süddeutschen Raum.* (*Position and problems of plant breeding in the South German area*). (*pp. 34–40*).

The undesirability of an excessive reduction in the number of varieties of the various crops is exemplified by instances in which varieties have proved entirely unsuited to certain local conditions or requirements in Germany. The present tendency towards the unification of varietal types should therefore be curbed to some extent, and this has been recognized in southern Germany.
The necessity for raising both yield and quality by the improvement of cereals and fodder crops is discussed.

Kiessling, L. — *Gemeinschaftsarbeit in der deutschen Pflanzenzüchtung.* (*Communal work in German plant breeding*). (*pp. 41–48*).

The necesity for co-operation between private and official plant breeding concerns in the universal campaign to increase crop production in Germany is made clear and questions of general organization and the lines on which co-operation might be achieved are discussed, with due regard to the existing economic background.

Honecker. — *Die Bedeutung von Letal- und Defektfaktoren bei der Gerste.* (*The importance of lethal and deficiency factors in barley*). (*pp. 80–92*).

The nature and occurrence of mutations conditioning defects in barley are outlined, with descriptions of the characteristic effects of the various spontaneous chlorophyll mutants, such as the albino, the xantha and the virescens types, that have been recorded from time to time. Two forms of dwarfing, both recessives, are also mentioned in one of which the leaves remain

rolled for a long time. Mutants found in 1924 with from 15–20 or more internodes are also described. The condition is recessive. One mutant resulting in the production of sickly plants is interesting in that it is dominant and only the heterozygous form survives, the homozygous dominants being eliminated at an early stage in ontogeny. Another dominant mutant takes effect at a similar stage and results in the so-called ever-sporting type of "blindness" in barley.

A number of mutants causing complete or partial sterility are also described and the occurrence of a correlation between sterile florets and smooth awnedness is suggested from observations on varieties grown at Weihenstephan.

Hampp, H. — *Vorkommen, Entwicklung und wirtschaftliche Bedeutung des deutschen Hopfenbaues.* (*Occurrence, development and economic importance of German hop cultivation*). (*pp. 92–98*).

The history of hop growing in Germany is reviewed and the economic importance of the industry pointed out.

Existing German varieties are nearly all mixed forms, but systematic selection for uniform types is now being applied to varieties that are of value. Selective breeding combined with tests of the vegetative progeny of the parent plants is also being carried out but only experimentally. Hybridization work is still in the early stages and the difficulties that have to be encountered in hop breeding are enumerated. Breeding for *Peronospora* resistance has been more rapidly successful than was expected. Aroma is the character which presents the greatest difficulty to the breeder.

Bickel. — *Allgemeines über die gartenbauliche Pflanzenzüchtung.* (*General observations on the breeding of horticultural plants*). (*pp. 98–104*).

The causes of the relatively slow development of horticultural plant breeding and its various vicissitudes in Germany up to the present day are reviewed. Among the reforms mentioned are the certification of varieties and the elimination of undesirable superfluous types. The importance of general co-operation in the production of horticultural plants with those qualities that are desirable from the economic and the commercial standpoint is urged.

In order to facilitate the necessary research which should accompany the future programme of improvement, a central institute for the breeding of horticultural plants should be established. Definite lines of work should be formulated and seed control centres should be created. Economic protection for the breeder should also be ensured.

Kampe. — *Tagesfragen der gartenbaulichen Pflanzenzüchtung.* (*Questions of the day in the breeding of horticultural plants*). (*pp. 104–07*).

The establishment of an institute for horticultural plant breeding is urged. Systematic research upon particular species should be undertaken. The various problems awaiting solution are stated with reference to the economic requirements in regard to peas, beans, onions, tomatoes and cabbage.

Mann, M. — *Aufgaben in der Blumenzüchtung.* (*What should be done in the breeding of flowers*). (*pp. 107–11*).

The importance of seed improvement in flower breeding is emphasized. The questions raised are treated mainly from the economic standpoint, though certain general genetic principles of interest to the practical breeder are also mentioned.

Jöhnssen, A. — *Die Umstellung des deutschen Weinbaues auf Rebklone.* (*The adoption of clones in German viticulture*). (*pp. 111–16*).

High yield, quality, immunity to diseases and pests, earliness, frost resistance, and keeping quality should be among the aims in the future vine breeding programme in Germany.

The importance of clone selection and Zimmermann's methods of testing the performance of

clones is discussed with reference to the ultimate provision of supplies of suitable clones through special official centres for raising such material. The necessity for developing resistant stocks is also considered.

Husfeld, B. *Photoperiodismus bei Reben.* (*Photoperiodism in vines*). (*pp. 116–23*).

Photoperiodism is defined and a number of experiments, some of which have already been reviewed (Cf. "Plant Breeding Abstracts", Vol. VI, Abst. 1016), are recorded with observations on selfings and F_1 and F_2 generation hybrids from European x American varieties, indicating that the type of photoperiodic reaction is probably a heritable characteristic in the vine. Incidentally the finding was also of interest that in one and the same clone infection with *Plasmopara viticola* varied with length of day. A similar relationship was found to hold for *Pseudopeziza tracheiphila* infecton and for *Phytophthora* infection in the potato.
The importance of further research in photoperiodism in relation to vine breeding is recognized.

Becker, G. *Genetik in der gartenbaulichen Pflanzenzüchtung.* (*Genetics of garden plants*). *pp. 123–39*).

The history of the development of plant breeding is outlined from early times up to the present day and the question is raised as to how the theoretical knowledge that has been amassed and applied to the breeding of agricultural plants can best be utilized in practical horticulture too. Since a knowledge of genetical principles is essential for such progress, selection, hybridization and also polyploidy and mutation used as methods of breeding are explained for the benefit of the practical man, with concrete examples and instances of what has been achieved by their use. Under hybridization crossing with wild forms, transgressive segregation and heterosis are discussed.
The importance of a knowledge of the floral biology of whatever particular plant has been chosen for improvement by breeding is stressed, with instances of how it can be utilized to simplify or shorten the processes involved in the production of the new forms.

Wheeler, W. F. 575.1:576.12

Inheritance and evolution.

Methuen & Co., Ltd., London 1936 : 3s. 0d. Pp. xii + 116. 33 illus.

As a simple but reliable presentation of the main facts and theories of genetics, cytology and evolution in the light of modern knowledge the small volume before us can be confidently recommended. The main phenomena are described in a lucid and interesting way, examples being taken both from the animal and vegetable kingdoms.
Having presented the facts of these three sciences an attempt is made to combine them, firstly heredity with cytology and finally with evolution in the last two chapters on Darwinism and neo-Darwinism; here the role of mutation in providing the material and of natural selection in providing the mechanism of evolution is described and special attention is given to the evolution of dominance.
The volume terminates with a glossary of terms and an index, whilst references to the literature are given at the close of each chapter.

575.243:576.356.5

The experimental production of haploids and polyploids.

Imperial Bureau of Plant Genetics, Cambridge 1936 : 5s. 0d. Pp. 26.

The recognition of the importance of haploids and polyploids, not only from a theoretical point of view but also because of their economic value, has led to an increased interest in their artificial production.
The short review of the more recent literature given at the beginning of this bibliography shews not only the variety of methods that have already been used successfully for the experimental production of haploids and polyloids but also the range of genera and species from which they may be produced.
The bibliography includes nearly 300 titles.

HESSE, R. 576.12
Abstammungslehre und Darwinismus. **(Evolution and Darwinism).**
B. G. Teubner, Leipzig and Berlin, 1936 : RM. 4.20.† Pp. 108. 64 illus.

The various lines of evidence for the existence of evolution, such as the morphological, the developmental and the geological are presented clearly and succinctly, largely on the plan in which they were put forward originally by Darwin. The evidence from the geographical distribution of the species and the correspondence between the fossil and living forms and the history of the continents is particularly convincingly expressed. A relatively full account is given of the studies of island flora and fauna and of the effects of the ice age, shewing that the facts are incapable of explanation without the assumption of evolution. Similar arguments are shewn to apply to evolution in man.

The explanations put forward by Darwin to explain the process of this evolution, such as natural selection and the survival of the fittest, are outlined and the principles illustrated with a number of interesting examples. Next, the main objections that have been raised to the validity of the natural selection theory are discussed. It is shewn that natural selection has in the case of so many organisms entirely failed to increase adaptation and is dependent for its action on the existence of the necessary variation in the organism itself. This is illustrated by reference to the laws of heredity. Given the initial variation, the examples given leave little doubt of the validity of natural selection as a mechanism for producing adaptation. The main source of the initial variation is shewn to be in mutations. The role of isolation of various kinds in the differentiation of species is discussed and the view emphasized that intersterility is the cause, rather than the result, of an accumulation of differences leading to the establishment of distinct species.

The book concludes with a brief discussion of the popular problem of the origin of life and a list of works recommended for further study. It makes no claim to be a complete treatise on evolutionary theory, but to present Darwin's main theses and evidence in a form acceptable to modern students in the light of recent knowledge.

GAGE, S. H. 578.6
The microscope.
Comstock Publishing Company, Inc. Ithaca and New York 1936 : $4.00.
Pp. viii + 617. 313 figs.

A textbook of the microscope and microscopical methods for students and research workers. After a chapter on microscopes and their parts the author describes in some detail bright-field microscopes and their use, then dark-field microscopy, the polarizing microscope and the optics involved in microscopy, the micro-spectroscope and the ultra-violet microscope. There follow chapters on the interpretation of appearances, magnification and measurement, drawing and demonstrations and on photography. Over one hundred pages are devoted to the topics usually included under microtomy, followed by a new chapter on micro-incineration and a brief history of lenses and microscopes. The book concludes with a bibliography, an index, a table of natural sines and data for changing from metric to English measures and from Centigrade to Fahrenheit.

Two notable features of the book are the lucidity of the exposition and the provision of practical exercises to illustrate the theoretical points the author makes. The author is Emeritus Professor of Histology in Cornell University, and so on the practical side the book is almost entirely concerned with the biological aspect. To those biologists who regard microscope technique as anything but a necessary evil this book will be most useful; to the plant cytologist who wishes to develop this part of his technique it will serve as an admirable, and in many cases necessary, introduction to the more specialized methods developed by Belling.

† 25 per cent reduction outside Germany.

STILES, W. 581.1
An introduction to the principles of plant physiology.
Methuen & Co., Ltd., London 1936 : 27s. 6d. Pp. viii + 615. 55 illus. 5 pls.

After having been for many years virtually without a modern textbook, English students of plant physiology now have two, the book under review being the second which has been published within the last eighteen months. It is divided into four parts, Book I dealing with the general physiology of the plant cell, Book II with metabolism, Book III with the physiology of development and Book IV with irritability and movement. In general the treatment leans towards the purely physiological rather than to the bio-chemical. A bibliography and index are provided.

Of special interest to plant breeders will be the chapter on reproduction in Book III, which includes among other things a brief account of the work of Lysenko and others on vernalization, to which, however, there is no reference in the bibliography. It would therefore appear that the latter is not meant to be complete, though this is not stated.

Apart from the rather restricted treatment of the biochemical aspects, mentioned above and in the author's preface, the scope of the book is wide and it will form a valuable addition to the library of any student interested in the science of plants.

NEWBIGIN, M. I. 581.9
Plant and animal geography.
Methuen & Co., Ltd., London 1936 : 12s. 6d. Pp. xv + 298. 39 illus.

The book under review was being prepared for the press by the later Dr. Marion Newbigin at the time of her death, and has been revised and completed by Florence M. Newbigin and Professor H. J. Fleure; chapter IV on soils and soil study and chapter V on climatic changes and their effect on the plant cover were written by Margaret Dunlop.

The account is divided into four parts, Part I, headed "Life and its environment", Part II covering the major plant communities and their animal associates, Part III the taxonomic distribution of plants and animals, and Part IV the factors of plant geography. The subject matter is largely what botanists term ecology, but the treatment is on very broad lines, and the book is evidently written for the student of geography rather than of biology. It is very readable, and while it does not deal especially with the particular aspects of the problem which are of most interest to plant breeders, it is to be recommended in that it supplies the necessary geographical background for a more detailed study of the distribution of economic plants. Suggestions for further reading occur at the end of each chapter and an index is provided. The note at the end of chapter II will need to be amended in later editions; it refers the reader to the Appendix for further details on the orders of the higher plants, but there is no Appendix.

KOMAROV, V. L. (Editor). 581.9(47)
(Flora of the U.S.S.R. Volumes I-V. Index to Volumes I-IV).
Edited by the Scientific Academy of the U.S.S.R., Leningrad, I, 1934 : 8 roubles : Pp. xvi + 302. 14 illus.; II, 1934 : 20 roubles : Pp. xxxiii + 778. 50 illus.; III, 1935 : 15 roubles : Pp. xxv + 636. 30 illus.; IV, 1935 : 17 roubles 50 kopecks : Pp. xxx + 760. 44 illus.; V, 1936 : 17 roubles 50 kopecks : Pp. xxvi + 762. 49 illus. Index Vols. I–IV : 1936 : 5 roubles : Pp. vi + 128.

The first volume of the Flora of the U.S.S.R. was issued in 1934, and up to the present five volumes in all have appeared. The first volume deals with the Archegoniatae, with the exception of the Bryophyta, which are treated in a separate series devoted to "spore-bearing plants". Then come the Gymnospermae followed by the first groups of the Monocotyledoneae. These are continued in the second volume, which is almost entirely devoted to the Gramineae. The monocotyledons are continued in Volumes 3 and 4, and Volume 5 starts the dicotyledons. The species are described in Russian and many of them are admirably illustrated. The print is excellent and each volume is supplied with adequate indexes of the Russian and Latin names. A bound index has also been issued for Volumes 1–4, and one presumes that the practice will be continued with later volumes of this monumental work.

FISCHER, C. E. C. 581.9(54.8)

J. S. Gamble's "Flora of the Presidency of Madras", Part XI. Addenda, corrigenda, indexes, etc.

Adlard and Son, Ltd., London 1936 : 7s. 4d. (Rupees 5). Pp. 1865–2017 + lxiv.

This, the last part of the flora, contains addenda, corrigenda, index to botanical names, index to vernacular names, title pages and suggestion for binding in three volumes, a brief foreword by Mrs. Gamble, a preface by A. W. Hill and an author's note by C. E. C. Fischer, notes on Part XI similar to those published in the "Kew Bulletin" for the other parts, abbreviations and signs, a glossary of botanical terms, an artificial key to the families and a map of the Presidency on which is marked most of the localities mentioned in the text.

The complete flora will surely represent an important contribution to our knowledge of the flora of India and of the tropics in general.

BEDEVIAN, A. K. 582:030.8

Illustrated polyglottic dictionary of plant names.

Argus and Papazian Presses, Cairo 1936 : 20s. 6d. Pp. xvi + 1,100 + XII. 1,711 illus.

Without a knowledge of Arabic, Armenian and Turkish in addition to the more commonly known languages, English, French, German, Italian and Latin, it is somewhat difficult to estimate fully the value of a work of this kind. Nevertheless a verdict, based upon the parts concerned with the last five languages mentioned, should have value for the majority of readers likely to require a polyglot dictionary.

The need for such a work became evident to the author during his student days at the Giza School of Agriculture 25 years ago, and the collection of plant names was then begun, while the actual compilation of the material thus accumulated was started two years ago, with the aid of his daughter and Mahmûd Kordi Eff., the latter contributing the Arabic index and other assistance.

The most striking feature of the dictionary is its simplicity and the systematic arrangement of the contents which facilitate the user in tracing any given plant with ease.

The opening pages are devoted to the abbreviations used and to an explanation in six languages of the general plan.

The dictionary section, which gives one or more equivalents in various languages of agricultural and other plant names in numerical sequence, is arranged alphabetically according to the Latin designation of the species, under which the various translations appear; the family to which the species belongs is given under the number under which the generic name first occurs. Numerous illustrations are also shewn. Not all eight languages are represented for each plant, but in view of the excessive difficulties and the delays which any attempt to fulfil such a requirement would have entailed, the point need not be stressed, more especially as the number of such omissions appears to be comparatively small. One frequent defect must, however, be mentioned, namely, the omission of capitals as the initial letters of German nouns, usually when preceded by an adjective; while, on the other hand, a capital has been wrongly given to the specific adjective in Latin under *Trifolium pratense*. Otherwise the work appears to be remarkably free from misprints.

The dictionary proper is followed by an indication of the method used in transliterating the Arabic terms, with keys to the pronunciation of the Arabic, Armenian and Turkish alphabets and notes on the pronunciation of Latin words. A bibliography of the works consulted and lists of addenda and errata complete this section.

The indexes which conclude the volume are admirably printed on paper of a different colour for each of the various languages, excluding of course Latin, and refer the reader directly to the number under which the required name appears in the dictionary. A convenient system of cross-reference in the case of botanical synonyms has also been devised.

The book is well produced and the type and binding suitably chosen.

The final judgment upon any work of reference can only be delivered after a period of use, but there is little doubt that the book under review should be of considerable value to students and research workers who are engaged in the study of agriculture, botany, horticulture or pharmacology and whose work involves the identification of plant names in European and other tongues.

RAPPE, G. 631.421
Prövning av en ny metod för utförande av enkla fältförsök. (**Examination of a new method for the carrying out of individual field trials**). C. W. Carlssons Eftr:s Boktryckeri, Vänersborg 1934 : Kr. 1.50. Pp. 52. 2 figs. 21 tables.

A method for utilizing a sampling procedure to estimate the comparative yield of adjacent manured and unmanured plots in various crops.

A method of working out standard errors of the sample determination is given.

631.421
RUSSELL, E. J. and VOELCKER, J. A. 63.0014(42.565)
Fifty years of field experiments at the Woburn Experimental Station. Longmans, Green and Co., London, New York and Toronto, 1936 : 18s. 0d. Pp. xvii + 392. 4 pls. 41 figs. 146 tables.

The Woburn Experiment Station was founded in 1876 by the Duke of Bedford and the Royal Agricultural Society for the purpose of carrying out certain experiments for which provision could not otherwise have been made. It is a matter for congratulation that the Station is still in existence, though it was at one time threatened with extinction. The experiments were in charge of Dr Augustus Voelcker until his death in 1884. They were then taken over by his son Dr J. A. Voelcker, who assumed responsibility when the Royal Agricultural Society gave up the farm in 1921. Since 1926 it has been looked after as a sub-station by the Committee of Rothamsted Experiment Station. The continuity of the main experiments has been unbroken for upwards of fifty years, and now, with the support of the Research Fund of the Royal Agricultural Society and the active assistance of the Director and staff of Rothamsted Experimental Station, it has been possible to survey, statistically and otherwise, the results over this period, and to publish them in book form.

The first part consists of an account of the experiments by Dr Voelcker.

Part II consists of a comprehensive statistical examination of the results, begun by Miss A. M. Webster and now completed and written up by W. G. Cochran. This is on lines made familiar in relation to the Rothamsted experiments by the work of Professor R. A. Fisher, and provides a valuable summary, first, of the meteorological data, of which continuous records were available; second, of the results of the continuous trials; and thirdly, of the effect of weather conditions on the yields of wheat and barley.

In the third part Sir John Russell discusses the bearing of the experiments on agricultural science and practice. It is possible that the results of this investigation could not be bettered in so far as it is possible to exhaust the potentialities of the old methods of experiment, i.e. the non-replicated lay-out. It is hinted more than once that more satisfactory results are to be expected on the basis of the modern methods of lay-out of field experiments.

Finally, Dr E. M. Crowther contributes a section from the soil chemist's point of view on the soils of the Woburn plots, and tables are given of the results of chemical analysis. A useful appendix of the primary data which have been the basis of the statistical examination is provided. We have in this book a very valuable and exhaustive commentary on the complete series of experiments, covering half a century of agricultural progress, and it provides a fitting testimony to the arduous labours of all those who have been engaged in this important work from the beginning. J. W.

631.531.12(43)
63.0015(43)
Bericht über die Tagung des Forschungsdienstes in Würzburg September 1935. Teil 1. Allgemeiner Tagungsbericht. (**Report on the Meeting of Research Workers in Würzburg, September, 1935. Part I. General report of the Conference**).
Forschungsdienst 1936 : Sonderheft 1 : Pp. 49. (Verlag J. Neumann, Neudamm und Berlin).

Contains the report of the general meeting and of the technical groups and agricultural institutes attending the conference, as well as reports of the special meetings relating to seed control, fodder plant investigations, soil science, etc.

631.531.12(49.6)
575:633(49.6)

CHRISTIANSEN-WENIGER, F.
Die Grundlagen des türkischen Ackerbaus. (**The basis of crop production in Turkey**).
Jordan and Gramberg, Leipzig Cl. vorm. Verlag der Werkgemeinschaft, Brüderstrasse 19, 1934 : RM. 30.† Pp. x + 476. 44 figs. 89 illus.

In considering the problems underlying crop production in Turkey much space is necessarily devoted to the study of natural conditions, and this aspect of the subject is dealt with in very full detail under the following heads :—topography of the country, its climate and soil—all of which are characterized by extreme contrasts often occurring within regions in proximity to one another. Such extreme and varied conditions have naturally resulted in a great diversity of forms in the flora and a medley of lines in the populations of the cultivated plants.

Forms and methods of cultivation are considered with special reference to the water supply and the inherent needs of the individual plant species. Pronounced differences in this respect are found not only between species but also between varieties and sorts of various species, and it is shewn that a certain type of agricultural practice may lead to natural selection, resulting in special plant types (e.g. the hardy, very drought resistant forms that have emerged after thousands of years of steppe agriculture). Such types are incapable of utilizing improved conditions of soil or climate and suitable forms must, therefore, be provided if full advantage is to be taken of improvements in cultivation. The various kinds of drought and their causes are considered and the nature of drought resistance in plants is briefly analysed with references to Maximov and Walter. The question as to whether drought-resistant strains of the cultivated crops of the Anatolian Steppe region exist or can be discovered is raised *en passant*, more space being devoted to the possibilities of cultivating the different crops with their characteristic reactions to drought and heat.

Cultural methods, soil management and the problems arising in connexion with seed production are fully treated. The importance of first-class seed of well adapted types is emphasized and also the wealth of hereditary characteristics available in the plant populations in Anatolia. The necessity for developing plant breeding along decentralized lines and the use of line mixtures are discussed from the standpoint of seed production.

This informative work should be of interest and instructional value to any who may be engaged in studying the lines along which agricultural development in Turkey may best proceed in the future and the problems that will have to be met in any scheme for the improvement of agricultural crop production.

The book is intended primarily as a stimulus and incentive to further action by those concerned for the welfare of Turkish agriculture and fulfils this purpose admirably.

The numerous sections on the various subjects are each completed by a bibliography of relevant literature and a number of interesting photographs illustrating regional types of country, agricultural implements and methods of work, etc. and the inclusions of subject and author indexes add to the agreeable mode of presentation of the whole.

633:551.566:016

Bibliography of tropical agriculture 1932, 1933, 1934 and 1935.
Int. Inst. Agric. Rome 1933 : Pp. 88 ; 1934 : Pp. 140 ; 1935 : Pp. 247 ; 1936 : Pp. 256.

The bibliography of tropical agriculture is issued annually and contains reviews of the papers dealing strictly with tropical agriculture and excluding the related subjects, economics, plant pathology, forestry and stockbreeding.

The subject matter is classified under the headings agriculture in general and then the plants themselves, according to their uses, starch, sugar, fibre plants etc., plants yielding oil, rubber, perfume, tannin, etc., insecticides, fruits, vegetables, forage crops, green manures etc., and weeds. The title of each paper is given in the original language (except in the Russian papers), and then follows the briefest possible indication of the contents in English and in French. Anyone concerned with tropical crops should find this bibliography of the utmost value for keeping in touch with the current literature and the constantly increasing size of the volumes is proof that everything is being done to make the survey as complete as possible.

633:575.1:581.192
63.0015(43)

Bericht über die Tagung des Forschungsdienstes in Würzburg September 1935. Teil 2. Vorträge. (**Report on the Meeting of Research Workers in Würzburg, September, 1935. Part 2. Papers read**). Forschungsdienst 1936 : Sonderheft 2 : Pp. 213. illus. (Verlag J. Neumann, Neudamm und Berlin).

This collection of papers contains *inter alia* numerous papers on plant nutrition and a contribution on the relation between chemistry and plant breeding already reviewed in "Plant Breeding Abstracts", Vol. VI, Abst. 1191.

Jonard, P. 633.11(44)

Essai de classification des blés tendres cultivés en France. (**An attempt at a classification of the soft wheats cultivated in France**).
Monographies publiées par le Centre de Recherches Agronomiques de Versailles, Minist. Agric. Paris 1936 : No. 3 : Pp. 264. 14 figs.

Demolon, A. *et al.* 631.8

Le fumier artificiel et ses applications. (**Artificial manure and its applications**).
Monographies publiées par le Centre de Recherches Agronomiques de Versailles, Minist. Agric. Paris 1935 : Pp. 49. illus.

Since 1928 the number of wheats cultivated in France has increased with such rapidity that it has become impossible for the farmer to choose among so many and such highly advertised new varieties. This situation made it necessary to issue an annual catalogue of species and varieties of wheat and as a preliminary to this as many as possible of the varieties cultivated in France had to be collected and studied.

The present monograph deals only with the soft wheats, *Triticum vulgare* Vill. There is a well illustrated account of the ear characters used for determination and a key for the identification of the varieties.

The ears of eighty-six varieties are then described including the reaction of the grain and ear to phenol.

A monograph on some of the uses of artificial manure is published in the same series.

633.11:664.641.016

Brotgetreide, Mehl und Brot. Vorträge und Berichte, gehalten auf der Arbeits- und Schulungstagung für Züchter, Müller und Bäcker am 9. und 10. Juli 1936 in Halle a.d. Saale. (**Bread cereals, flour and bread. Lectures and Reports of the Arbeits- und Schulungstagung für Züchter, Müller und Bäcker, 9 and 10 July 1936, Halle a.d. Saale**).
Forschungsdienst 1936 : Sonderheft 4 : Pp. 127. (Verlag J. Neumann, Neudamm und Berlin.)

This special number of "Der Forschungsdienst", although supplying no new material, furnishes a valuable summary of the status (at the time at which the papers were delivered) of knowledge and research on the breeding of bread cereals, particularly wheat, the testing of wheat for quality, the nutritional aspects of the bread problem, and flour and bread technology in Germany. Although only the first half-dozen reports are of direct interest to the plant breeder, all the articles could with profit be read by him, since the publication provides a survey of all the processes through which the material which he is breeding must pass, and the demands which will be made upon it; this, of course, is true only to a limited extent of countries other than Germany. The (translated) titles of the papers presented to the conference are as follows: I. *Introductory Remarks.* II. *Lectures on the Breeding of Wheat for Quality*:—(*a*) Quality wheat and the struggle for production (Krohn); (*b*) Experiences of a farmer and miller with quality wheat (Zapf); (*c*) Report on the (*German*) National Wheat Exhibitions, 1934–36 (Spennemann); (*d*) What measures can Germany take to increase wheat quality? (Scharnagel); (*e*) How have exporting countries improved wheat quality? (Rudorf); (*f*) Are there any satisfactory methods of determining the quality of wheat strains? (Roemer); (*g*) The control of grain pests (Kunike).

III. *Lectures on Bread Nutrition*:—(*a*) Bread in nutrition (HEUPKE); (*b*) Bread nutrition and milling grade of flour (SCHEUNERT).
IV. *Lectures in the Field of the Milling Industry*:—(*a*) The principle of (production) capacity in the grain economy (of Germany) (ZSCHIRNT); (*b*) Progress in the evaluation of flour in the Milling industry (BUGGISCH); (*c*) Important measuring methods for evaluating flour (ECKARDT); (*d*) Progress in wheat conditioning (LUCKE); (*e*) Dehulling and the digestibility of grain (MOHS); (*g*) Lectures on the technique of the determination of yield (BRÜCKNER).
V. *Lectures in the Field of the Baking Industry*:—(*a*) Present day problems of (wheat) dough-making (PELSHENKE); (*b*) What are the requirements of the housewife in regard to bread (GRÜSSER); (*c*) On the technique of the preparation of rye meal bread (BECCARD); (*d*) The influence of baking improvers on loaf condition (ZEISSET); (*e*) Bread competitions of the German Labour Front and of the baking industry (TISKA).
I. In the introductory notes the parts which can be played, respectively, by wheat breeding, conditioning in the mill, and the use of baking improvers, in rendering Germany independent of external sources of grain supply are indicated.
II(*a*). The results of the Wheat Exhibitions held in Germany from 1934 onwards have shewn that Germany now possesses both spring and winter wheat varieties which can be used to improve wheat of low quality by admixture with it in the mill. A general review is given of the progress of wheat breeding in Germany and the author forecasts the announcement of a German hard wheat suitable for use as a macaroni wheat.
(*b*) The experiments of the author led to the development of Zapfs oberfränkischer Landweizen which was tested in 1927 by the Seed-testing Station (Scharnagel) and found to belong to the group of wheats of good baking quality.
(*c*) The conditions relating to the entries for the National Wheat Exhibitions, and the reasons why these conditions have been imposed, are indicated. The best "universal" tests of quality are regarded as the gluten swelling test and the meal fermentation test, and it is recommended that both be used in conjunction so as to compensate for small variations.
(*d*) In Bavaria breeders have sought to improve the yielding capacity of "Land" wheats and to eliminate the older weak wheats, without losing the latter's good properties.
(*e*) The characteristics and origin of the wheats now cultivated in Canada and the Argentine are indicated. One fact which has emerged from the study of wheat cultivation in Canada is that good quality wheat cannot be produced from poor varieties in that country. The methods used in testing quality in Argentina are given and the Argentine Grain Law is outlined.
(*f*) It is stated that the gluten swelling and meal fermentation tests were taken up more rapidly outside Germany than in Germany itself. This appears in the case of the first test to be a rather surprising statement. These two methods are now official in Germany. The modification involving the use of only 2 grm. of meal meant that the fermentation test could be applied to the first generation of a cross. Experience through three, and to a certain extent four, generations has, according to Roemer, shewn that the micro-method on 2 grm. yields correct predictions of quality. The agreement between the experimental results of a number of successive generations, using the same method, with uniform manipulation, is very good in individual years, but we cannot compare those from different methods in different years. The meal fermentation test is preferable to the gluten swelling test for plant breeders since it requires less time, can be effected more rapidly, and since the differences between the various strains are more marked. When sufficient material is available the wheat must be tested by other methods; German workers have chosen the farinograph for this purpose and consider it to be more satisfactory than the baking test.
The author indicates at which generations of a cross each test should be applied.
The author recommends the use of the Hagedorn–Jansen maltose determination (which can be effected on 1 grm. of material) for those wheats having a test number above 50.
It should be possible with the aid of micro-methods to make rapid progress in the direction of developing winter wheats of good quality.
Among the remaining articles, that by Eckardt (IV.*c*) is the most important from the viewpoint of the wheat breeder. This forms a useful survey of the more important methods used by the milling and baking industries at the present time for evaluating flour. L.G.T.

Borasio, L. 633.11:664.641.016:578.081

Studi sulle farine di grano. Metodi d'analisi e di determinazione del valore panificabile. (**Studies on wheat flour. Methods of analysis and of the determination of baking value**).

Lab. Sper. Industr. Cereali, Staz. Sper. Risicolt., Vercelli 1934 : **9** : No. 10 : Pp. 99. illus.

Italy now produces enough wheat for her own requirements, but the quality of this flour needs to be improved. The present work is a study of the methods in use for the determination of baking value and begins with the analysis of the flour by chemical, biochemical and mechanical methods; there follows an account of the experimental tests of the bread itself.

Besides the actual appearance of the loaf other factors must be taken into consideration, such as texture of the crust and of the crumb, taste and keeping qualities, according to the requirements of the consumer.

633.491(8)
633.491:575

The South American potatoes and their breeding value.

Imperial Bureau of Plant Genetics, Cambridge 1936 : 3s. 6d. : Pp. 15.

A comprehensive account of the Russian and German work with the Central and South American forms of potatoes, dealing with the collection of the material, its systematics and cytology, the origin and early history of the domestic potato, photoperiodic reactions, frost resistance, disease resistance, the use of *Solanum andigenum* and the questions of short dormancy and culinary quality.

Ueberschär, K. 633.491:575(43)

Geschichte der Kartoffelzüchtung in Deutschland zugleich ein geschichtlicher Beitrag zur Sortenkunde. (**The history of potato breeding in Germany, an historical contribution to the study of varieties**).

Diss. Landw. Hochschule, Berlin 19. Oktober, 1929 : Pp. vi + 135.

A useful account of the development of potato cultivation and breeding in Germany from its earliest beginnings.

The history of the important varieties is recorded and a description given of the work of the leading breeders and of potato breeding institutes in Germany.

The spread of the two most serious potato diseases, wart and blight, is traced and the measures for their control by the breeding of resistant varieties are described.

Brückner, H. 633.71:577.1:679

Die Biochemie des Tabaks und der Tabakverarbeitung mit besonderer Berücksichtigung der chemischen Qualitätsbestimmung. Zugleich ein Beispiel der natürlichen Veränderung und methodischen Untersuchung pflanzlicher Genuss-, Heil- und Futtermittel bei ihrer Gewinnung, Verarbeitung und Aufbewahrung. (**The biochemistry of tobacco and tobacco manufacture with special regard to the chemical determination of quality. And an illustration of the natural changes and methods for the investigation of plant stimulants, remedies and food stuffs in their extraction, manufacture and preservation**).

Paul Parey, Berlin 1936 : RM. 19.80. Pp. xii + 446. 33 figs.

Not only are all the products of the tobacco plant considered from a biochemical point of view, but the results so obtained are used in an investigation of the connexion between the chemical constitution of tobacco and the character of the smoke and in the changes of the chemical composition of the tobacco in the course of manufacture and storage. The methods used in the chemical investigation of tobacco are described in an appendix.

The book provides a most useful survey of the present position of our knowledge of the chemistry of tobacco.

SHARPLES, A. 633.912–2

Diseases and pests of the rubber tree.

MacMillan and Co., Ltd., London, 1936 : 25s. 0d. Pp. xvii + 480. 70 figs. 4 tables. 4 pls. 11 diagrams.

The book is divided into three parts, any of which may be read independently of the other Part I contains general remarks on plant diseases, and the structure, reproduction and physiology of fungi. Part II treats briefly plant form and function, and Part III deals with the diseases and pests of the rubber tree. The diseases themselves are grouped under root diseases, tapping panel affections, stem diseases, scorching and after-effects and miscellaneous. Insect, animal and other pests are considered separately, there is a chapter on the treatment of diseases and one on forestry methods of cultivation. An appendix gives a list of the fungi recorded on rubber trees in Malaya and there is a glossary of some botanical terms.

The most important fungous diseases of Malaya are dealt with in great detail and the account of the history of the nomenclature of some of the fungi is a valuable aid in clearing up the confusion that still exists in some cases.

Other diseases of less importance to Malaya, and even some not yet reported but of importance elsewhere, are also described. The book is adequately illustrated by photographs and diagrams and should prove of the utmost value to the cultivator of rubber.

MACMILLAN, H. F. 634/5:551.566.1

Tropical planting and gardening. With special reference to Ceylon.

MacMillan and Co., Ltd., London 1935 : 4th Ed. 25s. 0d. : Pp. x + 560. illus.

A book of reference which is now in its fourth edition is its own recommendation, and one reading it for the first time can understand the steady demand for it. It is packed to the full with useful information concerning plant life in the tropics in all its aspects. About one-half of the book is devoted to tropical gardening, the other half dealing with plants of economic importance in tropical and subtropical countries. The information given, though condensed to a minimum, is always full of interest ; especially in the second part, which is almost encyclopaedic in its scope. The book was originally written with special reference to Ceylon, but is now of much wider application. The introduction says "As a guide to those proceeding to the tropics for the first time it should be invaluable". One feels inclined to say it is indispensable.

R.E.

FAWCETT, H. S. 634.3–2

Citrus diseases and their control.

McGraw-Hill Publishing Co., Ltd., London, 1936 : 2nd Ed. 36s. 0d. Pp. xv + 656. 187 figs.

The second edition of this valuable work, which is now issued eleven years after the publication of the first edition, has been largely rewritten and enlarged, in order to incorporate the new information accumulated through the research and observations of the author and numerous other investigations.

After a general survey of citrus diseases, their history, distribution, nature and treatment, the diseases, grouped under root and trunk diseases, diseases of branches, twigs and leaves and fruit diseases, are treated in detail.

The final chapter is devoted to the problems of deterioration and decay of citrus fruit, whether on the tree or during transport and storage.

Clearly written, with each disease most fully described, and the whole abundantly illustrated by photographs, diagrams and admirable coloured plates, the book should prove indispensable to all growers of citrus fruits.

634.9.00.15(71.3)

Proceedings of the Conference on Forestry Research.

National Research Council, Ottawa, November 26 and 27, 1935 : Pp. 71, A1–22, B1–12, C1–11, D1–9, E1–35, F1–5, G1–31, H1–7.

The Forestry Research Conference held at Ottawa under the auspices of the National Research Council was engaged in a consideration of the facilities available for forestry research and in the organization of the fullest possible co-operation.

Various aspects of forestry research were dealt with in the papers and discussions, including forest pathology, which is of comparatively recent development and in which the selection and breeding of strains resistant to disease is likely to become of first-rate importance.

HYDE, H. A. 634.97(42.9)

Welsh timber trees. Native and introduced.

Published by the National Museum of Wales and by the Press Board of the University of Wales, Cardiff 1935 : 2nd ed. : Pp. viii + 107. 24 figs. 25 pls.

As described in the preface by the Director of the National Museum of Wales, this is a plainly written but essentially scientific account of the principal timber trees grown in Wales. It has been revised and brought up to date for this, the second edition.

After the brief introduction in which the author touches upon systematic botany, ecology, forestry in Wales, and the properties of wood, he gives a synopsis of the classification of trees growing in Wales, including those which are not described later in the handbook, because their timber is of no commercial importance. The main part of the book is occupied by descriptions of the different trees with in many cases brief accounts of the properties and uses of their wood; the uses mentioned range from clog soles to aeroplane propellers.

The book is well illustrated by photographs and line drawings and is printed at the Oxford University Press.

634.97(73)

Famous trees.

U.S. Dep. Agric., Forest Service, Washington, D.C. October 1st, 1935 : Pp. 40 + 53 + 10. illus. (Mimeographed).

Contains brief accounts of the trees of America famous for their association with notable people, places or events.

634.972:634.956
633.584.3:634.956

Die Nachzucht von Pappel und Baumweide in den badischen Auewaldungen. (**The regeneration of poplar and willow in the wooded water meadows of Baden**).

Forstabteilung des Badischen Finanz- und Wirtschaftsministeriums 1935 : Pp. 16. 38 illus.

To meet the requirements of the timber trade the increased production of these woods within the shortest possible time is desired.

The various species of poplar and willow are briefly described from the point of view of their use in industry and of their habitat.

The methods, by vegetative propagation and by seed, for their regeneration, and for the transplantation of the young plants are then described.

There is a brief account of the main pests and diseases and measures for their control and the book is abundantly illustrated by photographs.

634.98(42)

An index of the minor forest products of the British Empire.

Imp. Econ. Comm., London, 1936 : 5s. 0d. Pp. 116.

As a result of a resolution passed at the Imperial Conference of 1930, a survey of the resources of the Empire countries was contemplated in order to promote the trade in minor forest products of the Empire. In view of the difficulty and expense of a complete survey of this nature, involving extensive local investigations, it was decided in this respect to limit the scope of the enquiry of which the present publication is a result. Moreover, for the purpose of the index a minor forest product was defined as any product of the natural forest other than timber and its derivatives.

The index comprises a tabulated summary listed under each of the minor forest products, e.g. drugs and spices, dyes, essential oils, fibres, gums and resins, oil and oilseeds, shewing the name of the commodity and species, exports, economic importance, country of origin and bibliographical references. The references to relevant literature are also conveniently classed in a separate section under subject headings, while three further alphabetical indexes of (*a*) commodities, (*b*) species, (*c*) countries, form a most useful completion of this compact publication for reference purposes.

NEW JOURNALS

Indian Science Abstracts.

(Being an Annotated Bibliography of Science in India).

This recent addition to the list of abstracting journals deals with all scientific papers published in India and also papers published abroad on work done in India or based on Indian material. The abstracts or title references are divided into nine sections, with the headings: General, Mathematics, Physics, Chemistry, Engineering, Geology, Botany, Zoology and Physiology; each section has separate pagination.

In the first issue there are some 28 pages devoted to botany, including two pages on economic botany. (Edited by Baini Prashad. Published by the National Institute of Sciences of India, Calcutta. Price: 7 rupees, 8 annas per number).

Annales des Épiphyties et de Phytogénétique Organe des Stations et Laboratoires de Recherches)

Successor to "Annales des Épiphyties", this journal, as its title indicates, includes articles on plant genetics as well as on plant diseases. The first volume covers the years 1934 -35, and some of the articles in it are reviewed in the present issue of "Plant Breeding Abstracts". Further numbers will be issued quarterly, four of these making a volume. The production of the journal, which is by the Imprimerie Nationale, is of a very high standard, and the articles themselves also set a high standard for other French journals. (Published by the Ministère de l'Agriculture, Paris. Price in France, per volume, 100 fr., outside France, 115 fr. Future numbers to be issued quarterly at a price of 30 fr. in France, 35 fr. outside).

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